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Ductile Cast Iron

A thousand members and visitors attended the session of the 53rd annual meeting of the American Foundrymen's Society, which was devoted to a study of the new magnesium-treated cast iron. The discussion was opened by Mr. D. J. Reese, of the International Nickel Company. He made observations of real interest to the foundry industry, such as, for instance, that nickel magnesium ductile iron can be made in any well-controlled foundry making ferrous castings; that it can be produced—without hazard—in all types of conventional melting equipment. The new material responds to heat-treatment. The spheroidal form of graphite is unaffected—within reason—by the sulphur and phosphorus content. Whether an all-pig or all-scrap charge be used is immaterial, provided there be adequate control. The new iron is not section-sensitive, the machinability is of a superior character and growth resistance better than when flake graphite is present.

The commercial aspects of ductile cast iron were also reported upon and illustrate the progress made. It seems that the largest daily production is of the order of 50 tons, and the largest number of casts made [in one day?] is also 50. Mr. Reese's comment on competition (we quote from an " Iron Age " report) is " while ductile iron might prove to be a bit of headache right now for the malleable industry, in the long run it will be found beneficial. Malleable foundries can use and are using this development." Production costs were said to be about $5 per ton of liquid iron treated, not including the raw material costs. An exhibit shown was an 8-in. pipe cast in ductile cast iron and carrying a 0.42 in. thick wall. Its tensile strength was over 22 tons per sq. in. made against a specification demanding a minimum of 8 tons per sq. in.

From Mr. Donoho's contribution we learn that when using a 70:30 copper magnesium alloy addition in 10-cwt. ladles, in conjunction with high-carbon base material, there was no trouble either with shrinkage or fluidity. Mr. Vennerholm, of Fords, preferred low-sulphur iron as a base metal, and commented favourably on the modulus of elasticity as shown by his experiments involving over a hundred casts. Mr. Max Kuniansky also preferred low-sulphur and phosphorus and high carbon. Dr. J. T. MacKenzie expressed his belief that nodular cast iron would not replace much grey iron. A disadvantage of the new alloy was lack of damping capacity for sliding friction.

This seems to give a very satisfactory picture of the way in which a new development has been taken-up in America, and must arouse in this country a sense of urgency for the need for publishing the results of British experience in this field of nodular irons. The Americans have repeatedly expressed their high appreciation of the pioneer work of the British Cast Iron Research Association in this particular field, and now we, on our part, must reciprocate by according to American industry full marks for the rapid way in which they have got down to " brass tacks " and publicised their practical results. It has been repeatedly said that no invention is of value until it is being handled by working men, and the gap between discovery and practical application is too protracted in this country. It is obvious that this lesson has been well learnt in America and we " sure appreciate their hustle."

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Meehanite Research Institute

Annual Conference at Glasgow

The seventeenth Annual Conference of the International Meehanite Research Institute was held from May 24 to 26 at the Grosvenor Restaurant, Glasgow. There was a record attendance of representatives from 44 licensee firms. Representatives came from France, Holland, Belgium, Italy, Denmark, Norway and Sweden as well as many from this country. The first day of the conference was wholly taken up with meetings of the Technical Research Committee and other standing committees, of the Meehanite Training and Educational Group and the Institute Board of Directors.

At the main session on the second day, Dr. N. E. Rambush, M.I.Chem.E., presided. In his opening remarks he warmly welcomed all representatives and called on new members by name to be presented to the meeting. He said it was a great pleasure and honour to preside over such a live progressive body as the International Meehanite Research Institute. He then went on to explain the purpose of the Institute, which was to promote and carry out research and study on all questions connected with the production of a dependable product to a high standard of uniform quality. The Institute was also concerned with gathering together all information on ironfoundry technique and ensuring that it was then made available to licensee members and their customers. The Annual Conference was the time when fresh information on all matters ranging from the control of raw materials to customer service was brought forward and discussed.

The Secretary reported that there had been very marked progress in all the activities of the Institute throughout the year. In addition, nine new licences had been granted and the firms were making progress; he mentioned that this now made a total of 131 Meehanite firms operating in various parts of the world. Several new licences for companies on the Continent, in India and South Africa were in the process of negotiation.

Dr. Rambush then read apologies from Mr. O. Smalley, O.B.E., their President, stating that he was unable to be present and wishing the Conference every success, and also from Mr. R. B. Templeton, President of the Institute of British Foundrymen, who was unable to be present owing to pressure of work.

Technical Reports

The chairmen of the various committees then presented their technical reports, and these were then discussed, beginning with the European Casting-service Records. These detailed the application of Meehanite castings in all types of industry and the service results obtained. Amongst the many excellent reports presented and discussed were:—Salt-cake Pots for Hydrochloric-acid Plant; The Plastics Industry as a Potential Market; Application of Cost and Production Control; Manual of Practical Ideas; Crankshaft Materials and Design Data; Use of Exothermic Materials for Efficient Risering; Infra-red and Electronic Heating and Drying; Theory and Practice of Venting Cores and Moulds; Properties of Some High-duty Cast Irons at Elevated Temperatures; Hardening without Distortion; Elements of Design with Meehanite. Various Papers on coke and its use, notch sensitivity, gating and risering practice, reports on sands, etc.

On the morning of the third day, a special session on practical foundry and metallurgical problems was held. In the afternoon, by the kind invitation of Mr. Henry Gardner and his co-directors, a visit was made to the works of Glenfield & Kennedy, Limited, Kilmarnock. As indicated in the vote of thanks proposed by Mr. G. B. Taylor, this visit was very much enjoyed.

Annual Dinner

The Annual Dinner was held in the evening of May 25, under the able and charming chairmanship of Mr. John Cameron, senr., J.P. Mr. Cameron was supported at the high table by the directors of the Institute and the International Meehanite Metal Company, Limited, together with a number of important guests, including Mr. V. C. Faulkner, Editor of the FOUNDRY TRADE JOURNAL, and Mr. Gordon Jackson, managing director of the Engineering Centre. The Chairman, in a delightful and interesting welcome to the guests, spoke of the immense progress made in the foundry industry. He referred to its early history and touched on some of the outstanding events throughout the centuries.

The toast of the Research Institute was proposed in a most amusing speech by Mr. Wilfred Harper and replied to by Mr. E. M. Currie, who paid tribute to the hard work of all those responsible for the Conference and its undoubted success; particularly, he referred to the work of Mr. A. Campion and his Research Committee. Mr. Currie spoke for everybody present in offering congratulations to Mr. Cameron on having just celebrated his 80th birthday.

Mr. John Cameron, junr., proposed "The Guests" in a short and witty speech, in which he stated that, to him, the guests were all those present except those who could claim to be Scotsmen.

Mr. V. C. Faulkner, Editor of the FOUNDRY TRADE JOURNAL, replying for the guests, commented on his pleasure at being amongst so many old friends. He said that he had watched the progress of this Institute throughout the years with interest and he noted that the members were quick to take notice of and use new ideas. That was as it should be. He then spoke of the possibilities of the use of "wet water" for quick and effective penetration of dust before sweeping the floors and thus ensuring better working conditions. Later, in the course of his entertaining remarks, he referred to the nationalisation of parts of the industry and to the unfortunate effect that the introduction of bureaucracy into industry seemed to have. He hoped that the Government would appreciate that, for efficient industry, which was vital to the country, there was a great need for far more flexibility of production than was possible under nationalisation.

Mr. S. Linander, of Limhamns Aduceringsverk Malmo, Sweden, also replied on behalf of the guests.

Producing Nodular Graphite with Magnesium*

Results of Practical Trials

By C. K. Donoho

The original research work leading to the production of nodular graphite cast irons was sponsored by the British Cast Iron Research Association and was publicly announced by presentations and publications of H. Morrogh *et al.* both in England and America in March and April, 1948. Morrogh revealed that by controlled treatment with cerium a hypereutectic, low-sulphur, low-phosphorus cast iron can be made to freeze with the graphite in a nearly spherical form instead of in the familiar flake form. This structural change brings about a substantial improvement in strength, ductility and toughness of the iron. The industry is greatly indebted to the B.C.I.R.A. for this development, which stands as an epoch-making contribution to cast-iron metallurgy.

At the American Cast Iron Pipe Company, where control of graphite form in cast iron had been studied for many years, this new development was naturally of the greatest interest. The British results on the effect of cerium were immediately confirmed, and subsequently tests with magnesium additions were carried on. From more than 150 experimental heats, with several casts from each heat, information has been accumulated indicating considerable promise for magnesium-treated cast iron as an engineering material.

Pure magnesium metal, with a boiling point of 1,110 deg. C., is gaseous at molten-iron temperatures and burns explosively in air. Any foundry planning experiments with magnesium additions to cast iron should keep in mind that magnesium in any form may be violently explosive. First trials should be made with small quantities of iron and with suitable protection for personnel and adjacent inflammable structures.

Nodular-graphite cast iron can be produced by adding pure stick magnesium on the surface of iron in the ladle. In spite of a loss of probably 95 per cent. of the magnesium, with an addition of around 1 per cent. sufficient magnesium may be retained in the metal to produce the desired effect.

Range of Magnesium Alloys Used

A search of various alloys of magnesium was undertaken in the attempt to develop an alloy which would give higher and more consistent recovery of magnesium and less violent a reaction during the addition. Table I shows typical results obtained with several alloys added to the high-carbon, low-phosphorus, low-sulphur type of iron favoured for the cerium treatment. The eight heats shown were melted in an acid-lined experimental induction furnace and the magnesium additions were made to the separate ladles poured from each melt. To each ladle, after the magnesium-alloy addition, 0.40 per cent. Si as 75 per cent. ferro-silicon was added and stirred in.

*Abstracted from *American Foundryman*.

Duplicate 1-in. diameter test-bars about 5 in. long were cast in dry-sand moulds from each ladle, and pins for spectrographic analysis were obtained for most of the heats. Cast-iron type tensile bars, 0.505 in. in diameter, were machined and tested from at least one bar for each ladle, and Brinell hardness values were determined on broken tensile bars after grinding a flat on the threaded end. Micro-examinations were made on sections from the broken tensile bars.

Results obtained with a 50 per cent. nickel-magnesium alloy are shown in melt I-329. Increasing additions of magnesium were made to successive ladles until with 0.63 per cent. magnesium added a fully nodular graphite structure was obtained. Analysis for magnesium in the iron is made by spectrograph using chemically analysed standards for comparison. In this heat 0.045 per cent. Mg is required completely to nodularise the graphite. Recoveries of magnesium with this alloy averaged under 10 per cent.

Melt I-330 shows results with three different magnesium alloys. An addition of 0.50 per cent. Mg as the Ni/Mg alloy produced nodular graphite in this iron, but both the Mg/Zr and the Mg/Ti alloys gave entirely flake graphite irons of normal strengths. Several other trial casts with zirconium and titanium alloys added in varying amounts always gave the flake form of graphite with no nodules. Other alloys with which no useful results could be obtained are Ca/Mg and Mn/Mg, although the latter was not tested extensively. Apparently there are some elements which, added with magnesium, render inoperative some nucleating mechanism which initiates the formation of nodular graphite.

Melt I-340 shows that magnesium aeroplane scrap (containing 9 per cent. Al and 2 per cent. Zn) is effective in producing nodular iron when added in sufficient amount. Ladle 4 of this heat was intended to be a higher addition of magnesium, but the addition was later found to be an alloy of aluminium instead of magnesium, which did not produce useful results.

Melt I-370 shows the effectiveness of a 50 per cent. Cu/Mg alloy in producing a high-strength nodular graphite iron. Alloys of magnesium with lithium and silicon were quite effective but showed no particular advantage in these tests. In melt I-410 a 70 per cent. Cu/Mg alloy is shown to give a very high strength nodular iron with an addition of only 0.40 per cent. Mg, and magnesium recovery was 10 to 17 per cent.

With 80 per cent. copper alloy, a 0.30 per cent. Mg addition was sufficient (melt I-374) and recovery of magnesium was more consistent. An alloy with 82 per cent. Ni gave magnesium recovery of over 20 per cent. and excellent properties with only 0.22 per cent. Mg

Producing Nodular Graphite

added (melt I-404). With this addition the irons contain about one per cent. Ni which adds to the strength. Melt I-402 compares the effect of the 80 per cent. Cu and the 82 per cent. Ni alloy. The copper alloy gave higher strengths, but the nickel alloy gave better magnesium recovery. This indicates that magnesium content can be too high for best properties, and that about 0.05 per cent. contained magnesium is normally about optimum. Other magnesium alloys which have been proved to be in some measure effective include Al/Mg, Fe/Mg and Bi/Mg.

In most cases the results of alloying to decrease the reactivity of the magnesium were somewhat disappointing. The 50 per cent. alloys of nickel and copper are substantially as explosive when added to molten iron as is pure magnesium, although the increased density of the alloys contributes to more consistent recoveries. Neither the iron, silicon nor aluminium alloys with 50 per cent. or more of magnesium showed any significant lessening of the reactivity.

Only when the magnesium was greatly diluted, as in the alloys of nickel and copper with about 20 per cent. magnesium, did the violence of the reaction substantially decrease. With about 20 per cent. magnesium, the nickel alloy is more violent than the copper alloy, presumably because the magnesium volatilises and explodes the still solid nickel, while in the copper alloy the copper melts before the magnesium volatilises. However, the magnesium recovery was somewhat better with the nickel alloy, as is shown in Table I.

Methods of Adding Magnesium

One practical method of treating iron in the ladle with magnesium is to use an alloy in which the magnesium is diluted to the extent that the reaction during solution is not explosive. The 80 per cent. Cu/Mg alloy is not explosive, but burns rather quietly on the surface of the metal, and is perfectly usable even within a crowded foundry. The 70 per cent. Cu alloy is distinctly more violent but can be used safely if some simple precautions are taken. It is said that with alloys of 90 per cent. or higher of nickel or copper with magnesium the metal is quiet and recoveries consistent.

Whilst the use of low-magnesium-content alloys appears to offer a safe method of adding magnesium to iron, it is hard to justify buying so much copper or nickel simply to dilute the magnesium. In some cases, of course, other alloys such as copper or nickel are required in addition to the magnesium, but the authors have shown that only magnesium is necessary to the production of high-grade nodular irons.

Another approach is to accept the hazards of adding pure magnesium and install protective equipment accordingly. It should be readily feasible to install a hood-protected station for magnesium addition in the foundry. Ladles for magnesium treatment could be

TABLE I.—*Effect of Adding Magnesium Alloys to High Carbon-Low Phosphorus Irons.*

Melt No.	T C.	Si.*	S.	Mn.	P.	Form of magnesium.	Magnesium per cent.			Tensile strength, tons per sq. in.	B.H.N.
							Added.	Found.	Recovered.		
I-329-1	4.05	2.33	0.037	0.59	0.07	Ni/Mg 50-50 alloy	0.25	0.025	10	5.6	111
-2	4.18	2.21	0.043	0.58	—	Ni/Mg 50-50 alloy	0.38	0.028	8	8.8	103
-3	4.13	2.61	0.040	0.60	—	Ni/Mg 50-50 alloy	0.50	0.029	6	12.5	90
-4	4.06	2.39	0.040	0.57	—	Ni/Mg 50-50 alloy	0.63	0.045	7	42.4	223
I-330-1	3.94	3.00	0.064	1.05	0.11	Zr/Mg 40-60 alloy	0.50	—	—	8.9	121
-2	3.90	2.91	0.046	1.19	—	Ni/Mg 50-50 alloy	0.50	—	—	40.5	235
-3	3.93	2.56	0.048	1.00	—	Ti/Mg 50-50 alloy	0.50	—	—	8.2	107
I-340-1	4.18	1.58	0.044	0.71	0.16		None	—	—	9.0	126
-2	4.16	1.78	0.043	0.71	—	Mg scrap	0.60	—	—	22.7	174
-3	4.14	2.02	0.047	0.78	—	Mg scrap	0.75	—	—	46.6	229
-4	3.96	1.68	0.047	0.69	—	Al scrap	None	—	—	10.0	143
I-370-1	3.57	2.20	0.027	0.64	0.06	Cu/Mg 50-50 alloy	0.60	0.053	9	50.5	255
-2	—	—	—	—	—	Mg/Li 90-10 alloy	0·75	0.048	6	38.6	255
-3	—	—	—	—	—	Mg/Si 80-20 alloy	0.60	0.060	10	43.8	223
I-410-1	3.62	2.61	0.048	0.55	0.037	Cu/Mg 70-30 alloy	0.26	0.029	11	18.8	192
-2	—	—	—	—	—	Cu/Mg 70-30 alloy	0·40	0·068	17	52.6	285
-3	—	—	—	—	—	Cu/Mg 70-30 alloy	0.55	0.056	10	51.1	255
I-374-1	3.71	1.87	0.030	0.60	0.08	Cu/Mg 80-20 alloy	0.20	0.024	12	10.1	103
-2	—	—	—	—	—	Cu/Mg 80-20 alloy	0.30	0.035	12	53·2	255
-3	—	—	—	—	—	Cu/Mg 80-20 alloy	0.40	0.065	16	46.7	293
I-404-1	3.44	2.19	0.040	0.62	0.03	Ni/Mg 82-18 alloy	0.22	0.058	26	56.0	285
-2	—	—	—	—	—	Ni/Mg 82-18 alloy	0.30	0.085	28	51.8	277
-3	—	—	—	—	—	Ni/Mg 82-18 alloy	0.42	0.094	22	47.4	285
I-402-1	3.70	1.82	0.045	0.60	0.07	Cu/Mg 80-20 alloy	0.22	0.044	20	52.7	285
-2	—	—	—	—	—	Ni/Mg 82-18 alloy	0.28	0.084	30	43.2	285
-3	—	—	—	—	—	Cu/Mg 80-20 alloy	0.36	0.058	16	52.1	285
-4	—	—	—	—	—	Ni/Mg 82-18 alloy	0.40	0.118	30	44.8	285

* 0.40 per cent. Si added as 75 per cent. ferro-silicon to each ladle just before casting.

run under the hood, magnesium metal or scrap added through a suitable chute, and the burning vapours should be exhausted to the atmosphere through a stack. After the reaction subsided, the ladle would be moved to the pouring floor.

Possibly more efficient methods will be worked out to protect the magnesium from burning, whilst bringing it into contact with the iron gradually, so that a reasonably complete recovery can be obtained.

Carbon Range

In addition to the cost of cerium, the drawback to the cerium process is that a high-carbon (hypereutectic), low-sulphur and low-phosphorus, base iron is required. The magnesium treatment appears to be effective in a much wider range of iron compositions. Table II shows results of an experimental melt to determine the effect of carbon content. To a high-carbon melt, successive additions of steel scrap and ferro-silicon were made to lower the carbon in steps while maintaining the rest of the composition fairly constant. Even when the carbon was lowered to 3.15 per cent. a ladle addition of 0.75 per cent. Mg followed by 0.40 per cent. Si produced a true nodular iron. In subsequent tests, nodular graphite was produced in irons as low as 2.50 per cent. in total carbon.

Effect of Other Elements

Sulphur content of the iron affects both the cerium and magnesium treatments as both are de-sulphurisers and the nodularising effect occurs only after sulphur has been brought down to a fairly low level. With magnesium treatment no particular difficulty was experienced in producing nodular irons from direct cupola metal containing about 0.09 per cent. S as melted. Some excess magnesium must be added, and the residual sulphur after treatment is usually found to be in the range of 0.03 to 0.04 per cent. With the magnesium treatment it may be found less expensive to add extra magnesium for de-sulphurising than to de-sulphurise with alkalies before adding magnesium.

In most of the tests manganese has been in the range of 0.50 to 0.80 per cent. There is some indication that with higher manganese contents less magnesium is required. In Table I, compare melts I-329-3 with I-330-2.

Phosphorus is said to reduce the solubility of cerium in iron so that nodular graphite cannot be produced by cerium in cast irons with phosphorus content over about 0.50 per cent. This limitation does not apply to the magnesium treatment, as nodular graphite has been readily obtained in irons with phosphorus up to 0.70 per cent. However, phosphorus must at present be considered as harmful element as the tests to date indicate that phosphorus over about 0.15 per cent. progressively increases shrinkage and lowers ductility.

Effect of Inoculants

In the amounts required to produce nodular graphite magnesium acts as a carbide stabiliser. For this reason a final silicon content of over 2 per cent. is preferred. Late addition of part of the silicon (inoculation) assists in breaking down carbides and prevention of mottling. In Table III melt I-347 shows comparison of Ni/Mg and magnesium scrap with and without the late silicon addition. It was thought that the aluminium present in the magnesium scrap might act as an inoculant. However, when the late silicon was omitted both alloys gave mottled structures in the iron used, which had a relatively low carbon content.

In melt I-346, comparison is made between two inoculants: 75 per cent. ferro-silicon and a granular graphite type of inoculant. Where the graphite inoculant was used (ladles 2 and 3) the graphite was entirely flake. Where no inoculant was used the iron was again mottled. Apparently, use of the graphite type of inoculant after the magnesium caused a reversion of graphite structure to the flake type.

Some tests were made where the magnesium and the ferro-silicon were added simultaneously. Although nodular graphite is formed by this procedure, repeated checks indicate that the structure and properties are slightly inferior to those obtained where silicon is added after the magnesium.

Optimum Magnesium Content

The preliminary testing of various magnesium treatments heretofore discussed was carried out on short 1-in. diameter test-bars. With this specimen, tensile strength, Brinell hardness and microstructure are obtained. Another test specimen used to evaluate nodular graphite irons is the ASTM standard 1.2-in. diameter bar tested transversely on an 18-in. span. Several bars of this type were cast and tested with varying additions of magnesium to several base irons.

It is apparent that amount of magnesium is critical. With too little magnesium micro-examination shows partially flake-graphite structures, and with too much magnesium the structures contain free carbides. It has been shown that high strengths are associated with high ultimate deflections, and that the optimum magnesium content for this iron is about 0.05 to 0.07 per cent. With this base iron one can feel reasonably

TABLE II.—*Effect of Lower Carbon Content.*

Melt No.	T.C.	Si.	S.	Mn.	P.	Crucible additions, per cent.	Magnesium, per cent.			Tensile strength, tons per sq. in.	B.H.N.
							Added.*	Found.	Recovered.		
I-344-1	3.85	2.70	0.016	0.65	0.10		0.75	0.048	6¼	41.5	212
-2	3.72	2.66	0.020	0.71	—	10 steel—0.25 Si ..	0.75	0.045	6	40.4	217
-3	3.48	2.69	0.023	0.69	—	10 steel—0.25 Si ..	0.75	0.060	8	33.6	223
-4	3.15	2.93	0.022	0.76	—	10 steel—0.25 Si ..	0.75	0.049	6½	44.6	229

* Magnesium added to each ladle as magnesium aeroplane scrap containing some aluminium and zinc. In each case the magnesium addition was followed by a ladle addition of 0.40 per cent. Si as 75 per cent. ferro-silicon.

Producing Nodular Graphite

confident of obtaining superior properties with additions of 0.35 to 0.60 per cent. of magnesium.

It is suggested that the most fruitful approach for a foundry initiating experiments with magnesium treatment is to add varying amounts of magnesium or magnesium alloy to a given base iron to develop a proper relation. With other variables—method and time cycle of additions and pouring conditions—held constant, the optimum range of magnesium to be added is most readily determined.

recognised, for example, that the effects of silicon inoculation disappear in 10 to 15 min. if the metal is held at temperature in a furnace, while if the metal is continually cooling in a foundry ladle the effects last much longer. In a foundry ladle we might expect to be able to hold magnesium-treated metal for 10 min. or so without losing the effect, but it seems likely that the magnesium (or cerium) addition will always be a ladle treatment made just prior to casting.

A series of round transverse bars ranging from 0.6 to 3 in. diameter were cast of magnesium-treated iron and tested transversely and in tension (Table V). To enable direct comparison, transverse strength is shown

TABLE III.—*Effect of Inoculation.*

Melt no.	T.C.	Si.	S.	Mn.	P.	Mg.	Ladle additions, per cent.	Tensile strength, Tons per sq. in.	B.H.N
I-347-1	3.15	2.41	0.033	0.72	0.07	0.052	0.60 Mg as Ni/Mg (50-50) 0.40 Si as FeSi	42.5	255
-2	3.20	2.42	0.035	0.69	0.07	0.042	0.60 Mg as Mg scrap .. 0.40 Si as FeSi	41.8	255
-3	3.25	2.08	0.039	0.68	0.07	0.065	0.60 Mg as Ni/Mg (50-50)	Hard to machine	352
-4	3.15	1.99	0.037	0.75	0.07	0.045	0.60 Mg as Mg scrap	Hard to machine	352
I-346-1	3.03	2.48	0.045	0.71	0.15	—	0.50 Mg as Ni/Mg (50-50) 0.40 Si as FeSi	41.6	269
-2	3.12	1.88	0.052	0.74	0.15	—	0.50 Mg as Ni/Mg (50-50) 0.75 carbon as graphite	15.0	187
-3	3.13	2.21*	0.053	0.57	0.15	—	0.50 Mg as Ni/Mg (50-50) 0.75 carbon as graphite	11.6	149
-4	3.10	2.21*	0.050	0.60	0.15	—	0.50 Mg as Ni/Mg (50-50)	Hard to machine	331

* Si increased about 0.40 per cent. in crucible

Effect Lost by Excessive Holding

Loss of the effect of the magnesium treatment by excessive holding in the ladle was suspected, since magnesium is oxidisable and since nucleation effects are notably evanescent. A test of holding time effect is shown in Table IV. The melt was held in the induction furnace at 1,500 deg. C. with the power on. A sufficient addition of magnesium was made to the melt and bars were cast at intervals, with the ferro-silicon added to the separate ladles. After 10 min. holding time there was less than 0.01 per cent. Mg in the metal and flake graphite was formed on casting. (A companion test with cerium treatment showed a like disappearance of the effect with about the same holding time.)

The conditions of maintained high temperature and contact with a hot silica crucible are much more conducive to rapid loss of magnesium than would be expected in normal foundry operations. It is well

as modulus of rupture, and stiffness by the so-called "secant modulus of elasticity." It is apparent that strength and hardness fall off with increasing section size, but the decrease is quite gradual, indicating rather less section sensitivity than would be expected in a normal cast iron.

Keel-block Tests

Standard transverse and tensile tests for grey cast iron are performed on round bars usually cast without feed heads. Since the mechanical properties of nodular graphite iron are so superior to those of normal grey iron, it was decided to test the material as cast steel would be tested. From several ladles of magnesium-treated iron, keel blocks of the type shown in the Steel Castings Handbook† were cast. The keel block legs, or coupons, were cut off and regular 2-in. gauge length, 0.505-in. diameter tensile bars were machined from one leg and tested in the as-cast condition. The

†Steel Founders' Society of America, Cleveland, 1941, p. 142.

TABLE IV.—*Effect of Holding Time.*

Melt No.	T.C.	Si.	S	Mn.	P.	Mg.	Ni.	Additions, per cent.		Elapsed time.	Micro-structure.	B.H.N.
								To crucible.*	To ladle.			
I-356-1	3.24	2.39	0.043	0.83	0.08	0.052	0.35	0.60 Mg as NiMg	0.40 Si	½ min.	All nodular ..	269
-2	3.24	2.39	0.043	0.83	0.08	0.029	0.33	0.60 Mg as MiMg	0.40 Si	3½ min.	25 per cent. nodular	223
-3	3.24	2.39	0.043	0.83	0.08	0.017	0.35	0.60 Mg as MiMg	0.40 Si	6 min.	15 per cent. nodular	179
-4	3.24	2.39	0.043	0.83	0.08	0.010	0.36	0.60 Mg as NiMg	0.40 Si	10½ min.	All flake	179

* Added at zero time to crucible.

companion leg of each keel block was given a simple anneal—800 deg. C., 1 hour, slow cool—and similar bars were machined and tested. Data are given in Table VI. Note that to the three arc-furnace irons (Nos. 3, 4 and 5) increasing amounts of magnesium were added. In No. 3 the magnesium content was insufficient for best properties; No. 4 was near optimum; and No. 5 had slightly excessive magnesium as shown by increased hardness and lower ductility.

Production Castings

Some experimental casts of pressure pipe and fittings of magnesium-treated cast iron have been made. Pipe in diameters from 8 to 16 in. have been cast and tested. Fittings from 6 to 24 in. in diameter and weighing up to 2,500 lb. were cast and tested to failure by bursting. Strengths generally were two to three times those obtained for similar castings of normal grey iron, but the toughness and impact resistance are even more impressive when the iron is completely nodular. The desired structure was not always obtained in these production castings.

In some instances, due to inexperience, too much or too little magnesium was added. In at least one case, the iron composition, especially the sulphur, came out differently from that which had been expected. The degree of control testing necessary to ensure uniformity in magnesium-treated irons will be established only when the process comes into commercial production.

TABLE V.—*Effect of Section Size—Cast 2748.*

	T.C.	Si.	S.	Mn.	P.
Analysis..	3.08	3.26	0.019	0.44	0.02

Added to ladle, 0.56 per cent. Mg as Ni/Mg (50-50) and 0.40 per cent. Si as FeSi.

Bar diameter, in.	Transverse test.		Tensile strength, tons per sq. in.	B.H.N.
	M.R., 1,000 p.s.i.	M.E., 1,000,000.		
0.60	185.8	7.5	44.4	254
0.875	155.0	7.5	41.0	235
1.20	147.4	6.8	35.8	229
2.00	135.0	6.0	34.5	201
3.00	128.1	6.0	34.1	201

Whilst the tests reported here indicate the possibilities of magnesium-treated nodular graphite cast irons, from the Author's point of view a great deal of development work remains to be done. First, the best method of introducing magnesium into the iron in routine operation needs to be worked out. Should one simply toss pure magnesium into the ladle and run, or should one use a lean alloy in which the magnesium is greatly diluted? Or, are there still better methods? It is probable that more experience will give the answer to these questions.

More complete data are needed with regular production cupola irons. While the Author has successfully treated several cupola irons, these data are more

TABL VI.—*Keel Block Tests—Mg Treated Irons.*

No.	Designation.	Furnace.	Ladle additions, per cent.	Analysis, per cent.						
				T.C.	Si.	S.	Mn.	P.	Mg.	Other.
1	Cruc. 6-4 ..	Crucible ..	1.00 pure stick Mg. 0.40 Si	3.70	2.58	0.028	0.41	0.040	—	—
2	I-343 ..	Induction ..	0.75 Mg scrap 0.40 Si	3.51	2.13	0.040	0.61	0.10	—	—
3	56838-1 ..	Arc ..	0.44 Mg as Ni/Mg 0.40 Si	3.42	2.81	0.031	0.60	0.027	0.039	0.34 Ni
4	56838-2 ..	Arc ..	0.56 Mg as Ni/Mg 0.40 Si	3.48	2.74	0.032	0.58	0.029	0.050	0.40 Ni
5	56832-1 ..	Arc ..	0.625 Mg as Ni/Mg 0.40 Si	3.50	2.59	0.028	0.53	0.10	0.080	0.60 Ni

Tensile Tests—0.505-*in. Bar.*

No.	As cast.					Annealed.				
	T.S., tons per sq. in.	Y P., tons per sq. in.	Elongation per cent.	R.A., per cent.	B.H.N.	T.S. tons per sq. in.	Y.P. tons per sq. in.	Elongation per cent.	R.A., per cent.	B.H.N.
1	41.0	26.8*	9.4	7.5	180	31.3	20.6	21.5	19.6	152
	41.7	26.8	8.1	6.5	186	31.2	20.4	17.8	18.1	141
2	36.8	22.0	11.2	9.8	170	31.1	20.1	20.4	19.6	143
3	35.0	24.5	3.6	1.5	170	28.3	23.1	11.5	4.0	152
	35.2	—	3.8	3.5	187	28.6	24.1	8.9	7.0	156
4	45.8	—	9.0	7.5	207	34.4	24.1	20.3	23.5	170
	45.1	28.0	6.7	5.5	212	33.9	24.2	18.6	23.2	163
5	46.7	29.8	4.3	3.4	241	32.2	24.2	16.5	14.0	170
	47.1	—	4.8	4.0	229	33.9	24.2	14.9	12.7	163

* Approximate.

Producing Nodular Graphite

limited than with the more carefully-controlled electric furnace or crucible irons.

Heat-treatments should be studied further. The Author has shown very promising properties obtainable with a simple 1-hour anneal at 850 deg. C., but other temperatures and times should be investigated with other base irons. Perhaps the brittleness found in the higher-phosphorus irons can be eliminated by suitable heat-treatment. Some preliminary tests on quenched and tempered nodular irons have indicated that valuable properties may be obtained by this type of treatment.

The combination of magnesium treatment with other alloy additions should be studied. If the optimum graphite structure is produced with magnesium, alloying with other elements to produce the optimum matrix structure should produce superior properties. Some tests on nodular-graphite irons with acicular and austenitic matrices have shown very promising properties. Graphitising inoculants other than ferro-silicon and granular graphite should be tried in conjunction with the magnesium treatment.

Such properties as wear, corrosion resistance, or damping capacity often determine the usefulness of a cast part rather than strength and ductility. These need to be evaluated for nodular graphite iron.

Summary and Conclusion

1. High-strength cast irons with the graphite in the nodular form are produced by incorporating in the order of 0.03 to 0.10 per cent. of magnesium in the iron.

2. Pure magnesium and several magnesium alloys are effective in producing nodular-graphite irons. Results were not effective with a few alloys.

3. Magnesium recovery and convenience of addition were found to be better with copper or nickel alloys of low magnesium content.

4. Advantages of magnesium treatment over cerium treatment are that magnesium is effective in low carbon, high phosphorus, and relatively high sulphur irons. The disadvantage of magnesium treatment is the difficulty and hazard of making the addition.

5. Ladle addition of a graphitising inoculant (such as ferro-silicon) after the magnesium addition is useful for controlling the structure or machineability of nodular irons. A granular graphite inoculant, however, apparently caused reversion to flake graphite.

6. There is an optimum magnesium content for a given base iron, too little magnesium resulting in a mixed structure, and too much magnesium causing increased hardness and brittleness.

7. Excessive holding time after magnesium treatment may result in loss of magnesium and reversion to flake graphite.

8. The effect of section size, from 0.6 to 3.0 in., is not particularly critical in nodular graphite irons.

9. Tests on keel block test-bars of magnesium-treated cast irons gave strength-ductility properties superior to most malleable irons and approaching those of cast steels.

10. Much development work remains to be done on methods of addition, adaptation to production, heat-treatments, alloying, and special properties of the material.

Acknowledgment

The Author is greatly indebted to the Dow Chemical Company, and especially to Frank Simons of the Magnesium Division, for valuable co-operation in supplying magnesium alloys and technical advise.

Bronze Founding Film

The story of bronze casting, both past and present, has been told, as it might appear to a youth about to enter the industry, in a film entitled "Bronze Founding," recently produced by Foundry Film Services, Limited, for the Association of Bronze and Brass Founders. The film, believed to be one of the first foundry films to be produced in colour, is on 16-mm. stock, runs for about 35 to 40 min., and carries a foreword by Mr. F. G. Burrell (past-President of the Association) and a commentary by Mr. Frank Phillips, whose voice is familiar to B.B.C. listeners.

In the early part of the film, the development of bronze and brass casting is traced from the pre-Christian era and many beautiful examples of ornamental work are shown, both from the ancient and the more modern. Stress is laid on the important part played by bronze castings in our daily life and phases of foundry production, from the pattern to the finished casting, are realistically portrayed. The presentation in colour brings out the spectacular nature of melting and pouring of bronze alloys and the groups of finished machined castings, shown thus in natural tone, are more impressive than would be possible with black-and-white rendering. Sufficient is given of the foundry techniques employed to show the nature of the jobs available for young men in foundries, but it is obviously left for on-the-spot authorities to substantiate the film by appropriate works visits and complementary training films.

At an informal meeting of the London area members of the Association of Bronze and Brass Founders, graced by the National President, Mr. Max Horton, which was held last week at the Clarendon Restaurant, Hammersmith, the showing of the film was sponsored by Mr. Frank Hudson, who had acted as technical director for its production. The film was described as having been made *by* foundrymen *for* foundrymen to interest, primarily, youths on the threshold of their careers. Second in importance was the need to impress upon people already in the industry the worthwhile nature of their endeavours and, thirdly, there was the chance to demonstrate to the public generally the real contribution that the bronze foundry industry was making to both cultural and utilitarian aspects of daily life. The opinion that all these objects were well attained was fully endorsed at the meeting and Mr. Hudson and his associates were warmly congratulated.

Provisional bookings for showing the film are now being accepted from members, non-members, educational establishments and kindred bodies. Persons interested should write direct to Heathcote & Coleman, Secretaries of the Association, at 25, Bennetts Hill, Birmingham, 2, from whom full particulars may be obtained.

Production of Medium and Heavy Iron Castings*

Improvements for the Jobbing Foundry

By G. W. Nicholls

(*Continued from p.* 499.)

MAKING LARGE CASTINGS

The pattern (Fig. 10) is located in the pit, and finally is firmly weighted to prevent movement when ramming commences. The mould is rammed by progressive steps of about 4 to 6 in. per ram. The procedure is to pack up a layer of facing sand about 6 in. deep and about 3 in. wide against the face of the pattern. This face is patted against the pattern and is then backed up by floor sand, which is rammed by hand- or air-operated rammer. Very great care should be taken to see that the edges of the mould next to the pattern and sides of the pit are solid.

As the ramming proceeds, all stiffening rods, hooks, core bearings, etc., are embedded in their proper place, and after each ram, rods are placed so that their ends will be within one inch of the pattern face in order to hold the sand and keep it from tearing when the pattern is withdrawn. The principal function of these rods is reinforcement. Bearings, which are necessary for cores so that their weight will not crush the face of the mould, are bedded and rammed in place. Bearings necessary for the bottom of the mould must, of course, be rammed and bedded in place before setting the pattern.

Gating Practice

In determining the number and size of gates, as well as their location, it is well to remember the importance of moulding clean smooth ingates at the bottom of the mould. It should be borne in mind that the cutting action of the metal is greatest at the bottom of the gate, where the direction of the stream is changed from vertical to horizontal, also that if the sand is kept in a rough condition the molten iron will wash some of it into the mould. Where such sand or dross sticks to the outside of the mould it usually does not affect the usefulness of the casting, but if it be trapped on a machined surface the results are generally fatal.

In some cases even if the sand is properly rammed and the runner properly formed, a certain amount of sand and steam is carried in to the mould through a boiling action set up in the metal from contact with sand that has not been dried sufficiently. A careful examination of the metal remaining in the runner system can frequently show how sand and other inclusions come to be trapped in the castings, for if, in the runner system, the solid metal displays knobs or other heavy irregularities, it is obvious that sand has been displaced and carried into the mould cavity, where it leaves a "sand" defect. This very often occurs near the ingate, and one method which can be adopted to minimise this defect is to include a wedge-shaped piece on the top faces of machine ways. It must be remembered also, that unanimity of opinion on gating methods never did, and probably never will, obtain amongst moulders.

Continuing the moulding, care must be taken properly to box off the vents at the back of the prints for the cores, so as to ensure positive escape of the gases. These boxed-off portions must be rammed up later when setting the cores. Such points are only incidental to the ramming, as also is the roughening

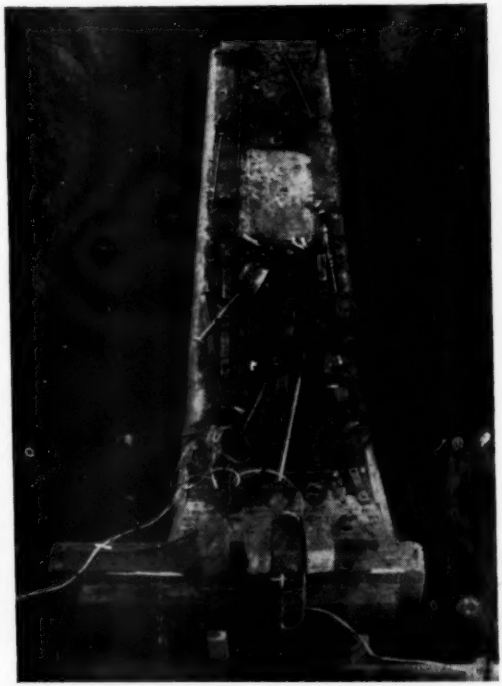


FIG. 10.—LARGE PATTERN BEDDED INTO THE MOULD PIT.

* "Factors for Immediate Consideration in Assisting in the Future Production of Medium and Heavy Iron Castings," read before the West Riding Branch of the Institute of British Foundrymen, Mr. Hammond presiding.

Medium and Heavy Iron Castings

or wetting of each layer before the next one is rammed, to ensure a good joint between them, but they are points which must be controlled.

Shrinkage and Feeding

As soon as the pit has been properly rammed and the joint finished, the top box is set in place. Next, the number of drying pans must be determined (additional remarks on this point are made later in the Paper). This is done by spacing pipes or wooden pegs three to five feet apart, and from 18 to 24 ins. from the side walls. The riser and feeder pegs are then carefully located, but in deciding the position and type of these, the following observations must be made. Basically, one of the chief problems of the foundryman arises from the fact that he must cast a liquid material into a mould and then take from this mould a solid of high quality, which will, within close tolerances, meet the demands of the designer. Of the total shrinkage, that which occurs on the change from the liquid to the solid state is the first concern of the foundryman. Because of this shrinkage, a uniform sectional thickness, as already referred to, is a cardinal principle in good casting design. Failing this, at least a progressive increase in section to a location where a feeder can be placed, is essential. There are three main stages in the cooling of the molten iron—liquid stage, solidifying stage and solid stage. Foundrymen should direct their energies to trying to obtain the combination of lowest possible shrinkage and free escape of gas, which will result in a sound, close-grained casting. It should be remembered that when the metal in a mould cavity freezes according to the principle of controlled progressive solidification, the coldest and thinnest-section metal furthest from the gates freezes progressively towards the hottest metal and heaviest section. This means that the freezing portion of the casting is being fed progressively by the slightly hotter metal ahead. The metal in the feeder must then supply the metal to fill the shrinkage requirements of the entire casting. So often, foundrymen use feeders adequate for a heavy section of the casting, disregarding the over-all shrinkage which may draw metal from a heavy section before it freezes and which loss must be made good by metal withdrawn from the feeders. Nevertheless, with a great body of cores or with hard cores, the expansion of the cores, and to some extent that of the mould, will compensate for some of the shrinkage tendencies.

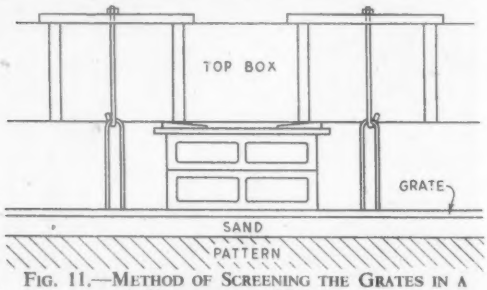


FIG. 11.—METHOD OF SCREENING THE GRATES IN A DEEP-JOINTED MOULD.

Moulding

Having decided on the type and number of feeders and risers, a layer of facing sand is riddled-on, the pattern gaggers are set, also the holding-down stalks for cores, riser pegs and pegs for drying holes, and the top is next rammed in layers similar to those when ramming the pit. Any necessary iron grates for the purpose of strengthening and carrying the sand in the deep joint are also incorporated. Such grates must be firmly secured to prevent any possibility of the top "dropping," and Fig. 11 shows one method of effecting this. After the top is rammed, stake guides are placed in position for drawing off the top, which is then removed for finishing. The pattern is then rapped and drawn. Usually, there are a few corners and pockets which break out and must be patched. All corners and crevices are sprigged (even though they have been well "rodded" during ramming), as are all flat faces on the bottom of the mould, particularly in front of the metal stream, and after final finishing to the contour of the pattern, the mould surfaces are coated with a good grade of mould wash. After being sleeked slightly and washed again the mould is ready for the portable dryers.

Mould Drying

In line with the inlets for the hot air, bent pieces of tin-plate are set on the bottom of the mould to keep the direct heat from the mould face, thus preventing it from burning. A burnt mould face is just as detrimental to the production of a sound casting as a wet or under-dried one. Packing pieces are placed on the top edge of the pit and the finished top is then placed on the packings, thus leaving a slight space between the joint to allow the hot air to circulate and dry the joints as well as the mould. The question for how long the mould is to be dried should not be based on guess-work. In the Author's case, it was found advisable to determine the maximum and minimum temperatures of the hot air delivered from the drying pans between coke charges and at the beginning and end of a working week, as the firing point began to clinker, at the same time varying top and bottom air supply. It was found that the temperature fluctuations were as much as from 800 to 300 deg. C. It was further established that approximately one pan was required delivering air at approximately 320 deg. C. per 16 to 20 ft. area of mould. It is best to apply the heat to the mould gently at first, to allow the escape of the steam and expansion of the sand to take place slowly. The heat input is then increased and the drying operation is continued until the mould is thoroughly dried. On large work this takes from 60 to 90 hours, depending on the size and the time required for coring-up the mould and casting. As a guide, however, the mould should have at least three inches of dry sand from the surface for work taking three days to core-up, and two inches for work

taking one to two days. If there be any doubt about the thoroughness of the drying, one of the core prints should be dug out and the depth of dry sand tested.

Core-making

In the making of the core, the same care must be taken as is taken in the moulding. The whole internal structure of the core must be thoroughly reinforced, all gates, rods and hooks should be securely fastened and locked so that the structure is able to withstand the uplift pressure within the mould when it is cast. Hooks must be placed so as to balance the core properly while it is being handled. Many cores weigh several tons and are handled by cranes; therefore, no chances can be taken of having one fall apart whilst handling. The centres of large cores are filled with coke or ash and faced with a depth of five to nine inches of sand according to size and weight. As with the mould, all corners or ribs of the cores are sprigged, and bedding plates for the scotching and stalking are placed in their correct positions. These are used to distribute the lifting force and so prevent the face of the core crushing under load.

After withdrawing the core-box, the cores are finished as completely as possible, and baked from 5 to 12 hours (according to their size) at temperatures between 200 and 250 deg. C. After the core has been baked and whilst it is still warm, but not hot, it is finished and washed with blacking dressing. Here the temperature is important; if the core be washed while too hot the blacking tends, on the cooling of the core, to crack and peel off (Fig. 12).

Use of Chills and Denseners

Chills and denseners are sometimes necessary when feeders cannot be conveniently placed to control the freezing rate, but when chills are used, great care must be taken that feeders are not so placed that they are too close to the chills and counteract the chilling efficiency (Fig. 13). It should be remembered that chills cause the shrinkage to move somewhere else unless they are placed with due regard to controlled progressive solidification.

All chills must be clean, and large enough for their densifying effect to penetrate across the section to be chilled, but not so large that they prematurely freeze the metal in the lighter or adjacent sections. Rapid pouring permits the chills to work most effectively. As circular-section ingates of the same area as rectangular ones will take metal more quickly, because of their smaller surface area it is preferable to use round gates when running over chills as shown in Fig. 14.

Core Setting

As each core is set in the mould, vent pipes are properly located in the boxed-off areas and rammed to prevent metal from entering. All cores should be set in the mould by using gauges and straight edges, and making sure that the proper metal thicknesses are maintained by chaplets and studs. The hooks are covered by facing sand and rammed, sprigged and blacked, and should be dried by fire if scabs are to be prevented from occurring at these spots.

As soon as the cores are set, whitening is placed on their top surface. Prints, joints and clay pads are placed on the mould surfaces to gauge the metal thickness. Then the top is tried on and all stalks are moved into place so that they match to the core in the correct position. The top is then removed and the mould is thoroughly inspected to see that no crushes have taken place, and that the vents, down runners and risers line up. Only when everything is satisfactory should the top be placed back in position.

Mould Closing

All risers should be built up on the top part before it is finally lowered into place. This ensures that the mould is free from the possibility of dirt falling-in during the ramming of the risers. In making the risers, it should be remembered that all liquids find their own level, and therefore all open risers should be at least as tall as the runner bush. Mould and core gas-pressure can be very high when molten metal touches the sand surfaces. High sand permeability and free venting can assist in preventing these pressures

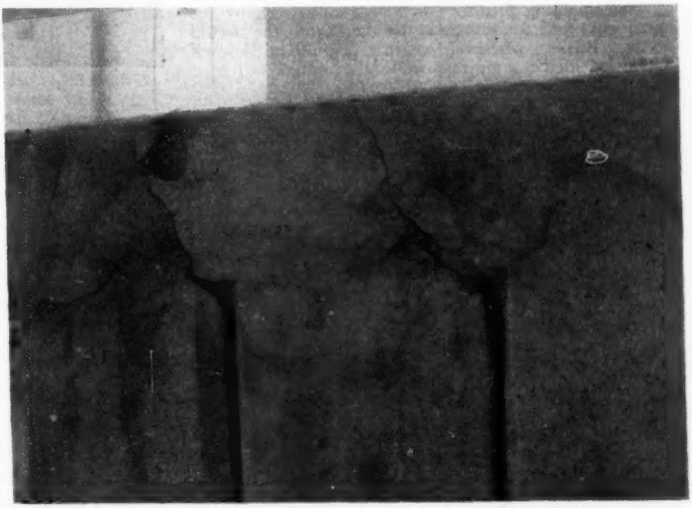


FIG. 12.—PEELING OF BLACKING FROM THE MOULD SURFACE (DUE TO INCORRECT APPLICATION).

Medium and Heavy Iron Castings

from building up. However, to provide a further safety factor against these gas pressures, it is recommended that liquid pressure of the molten metal should be so high that it exceeds the maximum gas pressure at the sand face. High liquid metal pressure is achieved simply by using tall risers and runner basins. After the top has been fitted into place, plates are wedged between the box and the side of the pit to prevent the top from being drawn down too far and causing a crush. Rails or steel girders are placed at right angles to the box bars and bearers are placed across these and bolted to permanent eye-bolts on the outside of the pit. Wedging and scotching of all stalks holding down the cores is next carried out and checked by a supervisor. This may seem unnecessary work, but, when the enormous pressure built up in a large mould during the pouring is considered, too many precautions cannot be taken to ensure a good casting. In fact, as an extra precaution, additional loose weights are sometimes placed on the top of the bearers.

Runner Basins

Runner basins are next built-up separately by using bricks and sand, and only too frequently one may find weeks of work spoilt due to a little neglect in the construction of this runner basin; for example, when wet sand is used. If much metal is to be poured, it is advisable to have a piece of cake core or loam bedded in the bottom, where the metal is first poured. Often, little attention is paid to the correct forming of the mouth of the down runner. Quite experienced men will sometimes draw a gate peg, leaving a sharp edge of sand standing proud, which is later broken by the metal plug and washed away by metal into the mould cavity. Bushes, wherever possibly, should be finished and dried in the same manner as the mould.

(To be continued.)

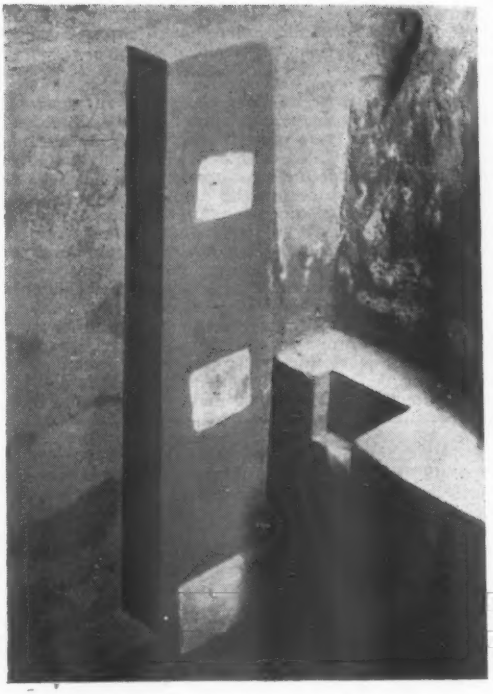


FIG. 13.—CHILLS INSERTED IN THE MOULD WALL TO PROMOTE DIRECTIONAL SOLIDIFICATION.

FIG. 14.—ROUND-SECTION RUNNERS (AT REAR) FOR DIRECTING THE FLOW OF METAL OVER THE CHILLS IN THE MOULD BOTTOM.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

ART FOUNDRY PRACTICE

To the Editor of THE FOUNDRY TRADE JOURNAL

SIR,—Having read Mr. Wizard's article (April 28 issue) and Mr. Hodges' subsequent remarks (May 19) I hope this letter will enlighten your readers on the points at issue.

(1) I cannot see or read into Mr. Wizard's article any mention of the frame strengthening the plaster during the making of the mould. It is quite obvious this refers to the plaster pieces or blocks made around the model.

(2) Regarding the number of blocks, the illustration (Fig. 5) explains itself. The writer of the article says "when *all* the sidepieces are in position." He does not say "when *both* of the side pieces are in position."

(3) I agree that the wedge runners are placed on the top of the model. Surely the top of the mould that was mentioned means the place where the runner sticks come together to the pouring point. It has been known for the 2-in. covering of sand to be rammed on to the model, the position of the runners and risers being marked by a fine nail tapped into the model, the sand being then cut away to allow for the insertion of the runner and riser gates.

(4) The practice of cutting-off the heads of the nails is usual where the sand pieces are small, but when the sand pieces are large and weighty the nail head, if it be flattened and punched well below the surface, acts as a good key for the sand and no marks are produced on the face of the casting.

(5) Spikes are very often driven into the mould after the tallow has been laid on the face of the mould. Mr. Hodges will perhaps remember the series of bottle-neck ½-folds on some of the intricate statues when he used to be my assistant in the early days. The aperture was far too small to allow of the spikes being driven in first. We used to indicate their position by means of fine nails. These were afterwards pulled out and the spikes were then hammered in the same direction without damage to the mould provided the job was done properly.

(6) The mould of a large figure is generally firm enough to allow the core to be made without any skin drying. Usually, by the time the main armatures have been made, the mould is ready to permit the core being made inside it without damage.

(7) Both Mr. Hodges and Mr. Wizard are correct with regard to the amount of the wax recoverable. As the wax is used over and over again in the course of a year the wastage would be 50 per cent. or more of the original taken. This calculation is fairly accurate judging by the amount of wax we have to order during the year to make up for this wastage. If the wax drains away from the mould without overheating, the amount it is possible to save from one mould during the operation could be as much as 90 per cent. or on average 75 per cent. But on repeated use during the year the amount of wax reclaimed is bound to shrink rapidly.

In conclusion, I consider Mr. Wizard has done a good job of work by putting his lecture over to the enthusiastic audiences at London and Birmingham, and I have received nothing but praise from the people who were privileged to attend those meetings.

In summing up "Art Foundry Practice," one can only apply general rules. After that, each job must be planned and carried out according to the intricacies of the particular part of the statue in hand. You, Mr. Editor, are very wise not to accept responsibility for any statements which appear in your valued journal. I do not propose to enter into any further controversy on this subject. This time I am claiming the privilege of a Britisher to express my opinion on a subject to which I have devoted the greater part of my life, viz.: "The Art of Bronze Founding."

I should like to finish with a story about tallow cores which is still told in art foundry circles. Some years ago a moulder made a tallow core in the jaw of a huge lion, this was an awkward bit of the core which he wanted out of his way. The tallow was lined in the mould, the frame was made, the tallow core rammed-up, and eventually the mould was put in the stove to dry. After drying, the mould was pulled out, and the tallow core could not be found. No spikes had been inserted in the mould to hold it in position. It was eventually found intact under the trolley, was placed back in the mould and supported by strips of copper. The top of the mould, when closed, held it in position. The result was a perfect casting. This shows that we cannot have any hard and fast rules in our branch of foundry work.—Yours, etc.,

ALBERT L. PARROTT
(Morris-Singer Company, Limited).

Forty Years Ago

Apparently the supply of ingot brass to the non-ferrous founder is of considerable age, but the Editor of the June, 1909, issue of the FOUNDRY TRADE JOURNAL was forthright in his comment as to quality. The makers could produce and sell cheaply, but they lacked metallurgical control. His warnings have indeed borne fruit, for to-day complete reliance can be placed on their ware. The Editor was also critical of the then chairman of the London County Council Education Committee for suggesting that a period of military service would be beneficial to boys destined to enter industry. He suggested the creation of Junior Technical Schools instead. The annual meeting of the Birmingham Branch of the British Foundrymen's Association, held under the chairmanship of Mr. R. Buchanan, reported that the membership was then 114. There are descriptions of two—one German and one American—automatic sand-preparing machines and quite a modern-looking rotary sand-blast machine by J. W. Jackman, but, of couse, it was "sand" and not "shot" in those days. An interesting hot-blast cupola—the Holland—was described and illustrated. In the stack above the charging door, the main from the blower discharged into a sleeve, from which was taken off pipes to the tuyeres. An interesting "patent of addition" would be to surround the sleeve with a few perforated baffle plates to absorb a little more heat.

Imports and Exports of Iron and Steel

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in April. Figures for the same month in 1947 and 1948 are given for purposes of comparison.

Total Exports of Iron and Steel.

Destination.	Month ended April 30.		
	1947.	1948.	1949.
	Tons.	Tons.	Tons.
Eire	3,428	6,353	5,697
Channel Islands	518	987	1,227
Gibraltar	319	369	84
Malta and Gozo	406	451	315
Cyprus	149	352	502
British West Africa	3,554	3,756	7,025
Union of South Africa	12,777	12,163	16,348
Northern Rhodesia	883	901	1,274
Southern Rhodesia	1,748	1,698	2,927
British East Africa	3,819	4,526	6,207
Mauritius	702	1,509	326
Bahrein, Kowelt, Qatar and Trucial Oman	305	3,207	1,804
India	9,942*	7,605	6,692
Pakistan		2,495	2,875
Malaya	1,599	2,828	3,085
Ceylon	1,207	1,052	1,262
North Borneo	410	165	688
Hongkong	2,503	3,178	3,714
Australia	1,493	6,884	16,327
New Zealand	5,917	3,653	8,691
Canada	577	700	8,942
Bermuda	73	39	39
British West Indies	2,224	1,654	6,665
British Guiana	302	699	294
Anglo-Egyptian Sudan	1,592	1,063	877
Other British countries	214	405	639
Russia	980	5,077	1,227
Finland	3,707	5,420	6,101
Sweden	5,361	10,075	4,735
Norway	5,946	4,180	5,941
Iceland	629	309	451
Denmark	9,865	5,532	6,830
Poland	63	462	55
Germany	310	17	23
Netherlands	11,072	5,179	10,742
Belgium	1,195	1,139	791
France	1,516	945	1,129
Switzerland	1,804	1,790	1,137
Portugal	1,216	1,652	1,174
Spain	263	265	580
Italy	1,152	650	210
Hungary	2	23	6
Czechoslovakia	128	65	6
Greece	497	294	527
Turkey	766	2,611	839
Dutch East Indies	880	1,038	2,413
Dutch West India Islands	261	981	691
Belgian Congo	10	203	186
French W. and Eq. Africa	276	123	10
Portuguese East Africa	264	92	189
Canary Islands	32	343	194
Syria	20	58	61
Lebanon	29	350	4,648
Palestine (Israel)	1,709	2,523	1,844
Egypt	2,057	4,417	4,393
Morocco	101	93	104
Iraq	3,751	4,086	6,434
Iran	2,044	8,593	10,617
Burma	5,624	1,052	723
Siam (Thailand)	288	197	275
China	4,451	788	242
U.S.A.	350	117	326
Cuba	30	81	62
Colombia	749	689	605
Venezuela	721	3,390	5,991
Ecuador	436	20	551
Peru	661	253	608
Chile	753	750	1,008
Brazil	1,928	3,385	1,407
Uruguay	1,598	636	283
Argentine Republic	12,329	6,562	324
Other foreign countries	3,229	1,815	1,802
Total	147,714	157,012	193,021

* Figures for 1947 relate to British India.

Total Imports of Iron and Steel.

From	Month ended April 30.		
	1947.	1948.	1949.
	Tons.	Tons.	Tons.
Australia	700	305	5
Canada	16,537	7,636	5,372
Other British countries	433	1,990	2,038
Sweden	1,018	1,524	1,123
Norway	744	3,628	2,833
Germany	—	516	445
Netherlands	523	207	12,073
Belgium	4,764	12,642	42,429
Luxemburg	65	1,205	26,402
France	60	59	14,004
U.S.A.	21,307	11,162	7,033
Other foreign countries	5	363	1,996
Total	46,156	41,237	116,653
Iron ore and concentrates—			
Manganiferous	28,925	—	—
Other sorts	560,563	774,813	696,562
Iron and steel scrap and waste, fit only for the recovery of metal	35,218	54,008	144,272

Exports of Iron and Steel by Product.

Product.	Month ended April 30.		
	1947.	1948.	1949.
	Tons.	Tons.	Tons.
Pig-iron	5,308	73	279
Ferro-alloys, etc.—			
Ferro-tungsten	121	65	28
Spiegeleisen, ferro-manganese	28	58	605
All other descriptions	64	62	145
Ingots, blooms, billets and slabs	339	632	131
Iron bars and rods	374	372	400
Sheet and tinplate bars, wire rods	104	272	186
Bright steel bars	2,432	2,188	2,023
Other steel bars and rods	11,958	7,981	17,057
Special steel	1,456	1,800	1,032
Angles, shapes and sections	10,057	6,681	9,968
Castings and forgings	345	546	650
Girders, beams, joists and pillars	2,528	2,127	2,668
Hoop and strip	3,753	3,185	3,024
Iron plate	55	513	225
Steel plate, ¼ in. thick and over	11,904	10,585	18,463
Do., under ¼ in. thick	5,689	8,133	12,964
Galvanised sheets	6,579	6,278	8,072
Tinplates	11,251	19,335	18,118
Tinned sheets	154	279	335
Terneplates	40	52	—
Decorated tinplates	6	106	—
Other coated plates	204	351	849
Cast-iron pipes, up to 6-in. dia.	3,465	3,601	7,003
Do., over 6-in. dia.	2,526	5,340	5,286
Wrought-iron tubes	15,695	20,585	30,271
Radiators, central-heatg. boilers	263	315	287
Railway material	15,618	18,154	14,180
Wire	5,519	3,335	3,770
Cable and rope	2,003	2,218	2,357
Netting, fencing and mesh	1,548	1,113	1,600
Other wire manufactures	582	583	755
Nails, tacks, studs, etc.	593	517	678
Rivets and washers	573	589	766
Wood screws	268	406	275
Bolts, nuts and metal screws	1,486	1,684	1,749
Stoves, grates, etc. (excl. gas)	589	907	797
Do., gas	103	231	206
Sanitary cisterns	40	138	194
Baths, sinks, etc.	99	576	869
Fencing material	586	206	380
Anchors, etc.	599	933	783
Chains, etc.	556	853	737
Springs	646	707	748
Hollow-ware	2,517	5,474	5,651
All other manufactures*	17,091	16,873	16,457
Total	147,714	157,012	193,021

* Figures for 1949 are not completely comparable with those for previous years.

Five Objections to the Steel Bill

B.I.S.F. President's Statement

Sir Ellis Hunter, president of the British Iron and Steel Federation, in a statement issued last week, reaffirmed the industry's fundamental opposition to the principle of the Iron and Steel Bill. He recapitulated these five outstanding objections to the Bill.

(1) The Bill would cut the industry and its voluntary organisations into two watertight compartments, one publicly owned and one privately owned. By expropriating 100 iron and steel firms the Government would abandon its impartial position of supervisor of 500 such firms which was of proved value to all concerned. It would acquire a vested interest in part of the field—a very large part of the field in the case of the cruder products, a decreasing but none the less appreciable part in the case of the more finished and engineering products.

(2) The corporation would take over all the activities of the 100 firms, including many far removed from iron and steel manufacture—the manufacture of floating docks, locomotives, umbrella frames and ink, for example, not to mention some 30 per cent. of Britain's constructional engineering capacity for bridges, power stations and the like and many valuable subsidiaries abroad.

(3) The Bill would give the new corporation power to take in any of the activities listed in the memoranda of association of any of the nationalised companies. Any company worth its salt sees to it that it has power to enter any field in which it could conceivably be interested and this provision, in effect, gives the corporation a blank cheque to do what it likes.

(4) The corporation would have a monopoly of crude steel production. It would, therefore, control both the volume and the price of the raw material supplies of its competitors and would be under constant temptation to subsidise its sales of finished products by charging a higher price for crude steel—and there would be no impartial supervisor to ensure equitable treatment between publicly and privately owned users of iron and steel. Owing to the shifting of the risk factor on to the back of the taxpayer, the corporation would be able to raise new capital at artificially low rates.

(5) By centralising ownership, the Bill must remove from managements the sense of full responsibility for the success or failure of their works and their proper development which in the last resort arises out of the fact that the firms are financially independent units.

Partnership Between Government and Industry

Sir Ellis said that discussion in the House of Commons had failed to deal with these five points or to show any constructive ground for the introduction of the Bill which had the effect of destroying the partnership which, for a number of years, had existed between the Government and the industry. "Under this arrangement," he said, "public supervision by the Board representing consumers, labour and management, had guided the general policy, while the industry itself had been successful in advancing rapidly a major development plan and in securing record levels of steel production."

Improving the Bill

The reason why the British Iron and Steel Federation had refused to assist the Government in the task of improving the Bill was that it might have been interpreted as willingness of the industry to co-operate in the task of its nationalisation. The Federation would continue to co-operate with the Opposition in the House of Lords, as it did in the House of Commons, in the drafting of amendments aiming at improving the Bill.

Sir Ellis claimed that the suspense created by the Bill had actually slowed down the development plans of the industry. Although the Bill was introduced in October, it was not until March that provisions were made for financing current development schemes. But for the Bill, the elaboration of the second five-year plan would be well on its way. As it was, it could not be proceeded with. The first five-year plan would end in 1952, but it was important that the second plan should be ready years before the end of the first, for to some degree they were bound to overlap each other, and many preparatory steps for the second plan would have to be taken during the period of the first plan.

G. &. J. Weir's Output Record

Increased Export Record

As in previous years, G. & J. Weir, Limited, engineers and founders, of Glasgow, continued last year to be handicapped by the lack of skilled labour and, more especially, by shortages in trained personnel and technical staff. Despite these handicaps, however, the company established a new output record for the firm during a peacetime year. The chairman, Lord Weir, states in the annual report that "this outstanding performance was exceeded by our orders for new work reaching an even higher level. Despite the slackening in the flow of orders placed for new shipping tonnage in the United Kingdom, marine sales continued high, without quite reaching those of the preceding year. Land sales showed an increase over 1947, an outstanding feature being the reception of the large contract for evaporating and distilling plants for the Dutch West Indies. A marked feature also of the year's sales was the increase in export orders. By the end of the year these were more than double those for the corresponding period of 1947."

Since December, 1946, the value of the company's export orders has been quadrupled, and this does not take into account auxiliaries which it supplied to ships building in the United Kingdom for foreign account. Notable in the export sales for 1948 were substantial contracts secured in Belgium.

Personal

SIR EDWARD APPLETON, F.R.S., has been elected an honorary Fellow of the Institute of Physics.

MR. F. L. OWEN has resigned from the board of the Brooke Tool Manufacturing Company, Limited.

SIR THOMSON MCLINTOCK has resigned from the board of Vent-Axia, Limited, ventilation specialists, of Putney, London, S.W.15.

MR. R. GRIFFITHS, a director of John Harper & Company, Limited, ironfounders, etc., of Willenhall, Staffs, has been elected chairman of the Willenhall Urban District Council.

MR. HAROLD FLETCHER, a director and secretary of the company, has been appointed assistant managing director of Derbyshire Stone, Limited. MR. J. S. COLLINGE succeeds Mr. Fletcher as secretary.

MR. A. R. STUBLEY, assistant to the carriage works manager, has been appointed assistant works manager in charge of the Doncaster wagon works of British Railways. He succeeds MR. G. W. TURNER, who has retired.

MR. JOHN RAITHBONE, of Hale & Hale (Tipton), Limited, malleable-iron founders, who has been awarded the British Empire Medal, has received presentations to mark the event. Mr. Raithbone has been with the company for 25 years.

MR. J. C. ARKLESS and MR. E. N. ROBINSON have been co-opted to the board of A. Reyrolle & Company, Limited, manufacturing electrical engineers, etc., of Hebburn, Co. Durham, following the recent death of the managing director, Mr. Harry Towers.

MR. E. SORENSEN, manager of the Great Northern Telegraph Company, Limited, Newcastle-upon-Tyne, and MR. K. M. PETERSEN, local manager in the Newcastle area of the Anglo-Swedish Welding Company, Limited, have been awarded the Order of Danneborg by the King of Denmark.

DR. A. T. GREEN, director of research of the British Ceramic Research Association and hon. general secretary of the British Ceramic Society, received the degree of D.Sc. *honoris causa* at a congregation of the University of Leeds on May 20, in recognition of his services to the science of ceramics.

MR. THOMAS H. HINCHLIFF, chairman of the Hepworth Iron Company, Limited, Hazlehead, Yorks, is to have the distinction of having his portrait hung in the Royal Academy. The portrait, painted by B. Fleetwood-Walker, was presented to Mr. Hinchliff by the directors to mark his 37th year as a director.

MR. SLATER WILLIS, managing director of Tinsley Rolling Mills Company, Limited, Sheffield, was presented with an inscribed cigarette case at a dinner given in recognition of his 50 years' service with the firm. The presentation was made by Mr. Frank Marsden, who has been employed by the firm for 62 years.

MR. W. H. MALCOLM, assistant general manager of the General Electric Company, Limited, Coventry, has been appointed chairman of the West Midlands Gas Consultative Council, one of 12 Councils to be set up under the nationalised gas industry to represent the interests of consumers. Mr. Malcolm is Mayor of Coventry.

Vickers' Bonus Issue

Sir Ronald Weeks's Warning

Lt.-Gen. Sir Ronald Weeks, chairman of Vickers, Limited, announced at the company's annual meeting in London on May 24 that the meeting to consider resolutions for capitalising profits and issuing bonus shares is to be held at St. Ermin's Hotel, Caxton Street, London, S.W.1, at 11 a.m. on June 8. Sir Ronald warned stockholders that the writing-up of their holdings would not carry any implication whatever as to the rate of dividend to be paid on the larger capital. The company had agreed to exercise moderation and restraint in dividend policy up to February next, but he assured stockholders that their interests would always be studied.

While, technically, the proposals could be classed as a bonus issue, he said, all that was being done by means of capitalising reserves was to restore to the ordinary stockholders the original nominal value of their investment and in some measure to bring the issued capital of the company into truer relationship with the capital employed in the business. On the past year's results, Sir Ronald said it would have been right and proper to pay a larger final dividend, but because of the appeal for dividend limitation the board recommended only the same distribution as in the past two years.

On the subject of the nationalisation of the steel industry, Sir Ronald asserted that if the English Steel Corporation, Limited, the group's steelmaking subsidiary, became State-owned, it would be "a severe blow to the general conduct of the whole group." The Corporation was essentially an engineering works and the bulk of its products was not scheduled in the Iron and Steel Bill. "Nationalisation of the whole or major parts of the Corporation and its subsidiaries may lead to disjointed conditions in certain sections of the alloy steel trade and the possibility of unemployment among the present workpeople, arising from loss of business—both home and export," he said.

"I would argue most strongly that it is to the benefit of stockholders and employees that none of the constituent members of Vickers should be torn away by the operation of nationalisation, and your board has taken, and is continuing to take, all reasonable and legal measures to protect stockholders' interests."

CLOSER CO-OPERATION between the universities and the steel industry in the training of students was advocated by Prof. Robert Hay, of the Chair of Metallurgy at Glasgow Royal Technical College, when he spoke on May 21 at the opening of an exhibition organised by the British Iron and Steel Federation recruitment and training committee in Glasgow. The academic side and the practical side should be balanced, he said. It was not a case of students going to the works for a few weeks, nor of works people going to college one day or a few evenings a week. The real balance was between the two—a few months in each place.

Law Cases

£1,000 Fine for Steel Offences

Moss Goodman (43), a director, of Rossmore Court, Park Road, London, N.W.1, trading as Moss Goodman & Company, scrap-iron and steel merchants, of Aldwych House, Aldwych, London, W.C.2, was fined £1,000 and ordered to pay 50 guineas at the Central Criminal Court on May 18. Goodman had pleaded guilty to an indictment containing 17 counts. Eight of these concerned the acquiring of steel contrary to Article I of the Control of Iron and Steel Orders of 1945 and 1948. Counts 1, 3, 5 and 7 related to acquiring steel from the Essex Motor & Engineering Company, Limited, and counts 2, 4, 6 and 8 to acquiring steel from J. J. O'Reilly. The remaining counts concerned the disposal of steel in contravention of the Control of Iron and Steel Orders. Counts 9, 11 and 16 related to the disposal of steel to Coopers (Metals), Limited, and counts 10, 13, 15 and 17 to the disposal of steel to the Essex Steel Motor & Engineering Company, Limited. Counts 12 and 14 concerned similar offences in relation to Hygienic Wire Works, Limited, and A.O. Metal Exporters, Limited.

Mr. Neville Faulks, prosecuting for the Ministry of Supply, said one of the objects of the Control of Iron and Steel Orders was to prevent raw steel being exported abroad and thus hindering production in this country. There were special circumstances under which licences could be obtained for the export of raw material, but they did not concern this case. The steel concerned in this prosecution was mild-steel angles and mild-steel sheet. What in effect Goodman did was to purchase steel from Mr. O'Reilly and the Essex Steel Motor & Engineering Company and sell it on.

The indictment referred to some 270 tons of steel, but from an examination of his books, which had been perfectly properly kept, these illicit sales amounted to 632 tons, at a profit of about £2,000. But, said Mr. Faulks, taking into account the amount of income tax and general office expenses which had to be deducted, it was doubtful if Goodman benefited personally by more than £1,000. Counsel said Goodman had given the Ministry of Supply every assistance in the matter, and consequently it was not put forward as a case with any particularly aggravating circumstances.

According to a statement which Goodman had made, he was licensed in 1939 as an iron and steel merchant to deal in scrap iron and steel. "When at the golf club I spoke to Mr. O'Reilly. I said it was my idea that the sheet steel should go for export, and he said 'All right,'" defendant explained in his statement. According to Goodman, all this steel had gone abroad, contrary to the Order. The result of this was that, being second-class steel, it might well have had damaging effects abroad and the trade's prestige might have suffered.

Mr. Bernard Gillies (defending) said that Goodman only acted as an intermediary, and he never comprehended that the very thing which the regulations sought to avoid was the export of raw steel. Goodman at the time was in grave financial difficulties, and it was because of this that he entered into these transactions thinking he might make some commission through Mr. O'Reilly.

Mr. Gillies added that Goodman owed the Iron and Steel Federation a sum of £4,000, but if the court thought fit to impose a financial penalty, there were friends willing to come forward to assist him.

After the fine had been imposed, Mr. Faulks said it was not proposed to take bankruptcy proceedings in this case.

Acquired Steel Without Authority

Parnall & Sons, Limited, iron and brass founders, of Bristol, was fined £500 at Bristol on May 17 for contravening the Control of Iron and Steel Order by acquiring 80 tons of steel without authority. The offence was admitted. Archibald Gabb, a director of the company and its works manager, was fined £50.

Mr. Beagley, prosecuting, said the steel was obtained from a firm at Bath.

For the defence, Mr. Kenneth Bain said Gabb was told the steel was of American origin and needed no authorisation. "Advertisements are appearing in the trade Press in which some firms are offering sheet steel for sale without permits," Mr. Bain said.

Contracts for Imported Metals

When, in the House of Commons, Col. Crosthwaite-Eyre asked the Minister of Supply to state, in relation to each base metal bought in bulk by his department, the length of contracts entered into and the countries with which such contracts had been made, Mr. G. R. Strauss circulated the following statement in the "Official Report":—

"My department has the following contracts for imported metal:—ALUMINIUM: The current contract covers deliveries from Canada up to March, 1950; COPPER: contracts cover deliveries up to the end of this year from Canada, Rhodesia, the Belgian Congo and Chile; LEAD AND ZINC: contracts cover deliveries up to the end of June, 1949, for both metals from Canada and Australia and for lead from Northern Rhodesia; TIN ORE: from Nigeria and East Africa. No period is fixed for these contracts, which are subject to termination by three months' notice; TIN METAL: from Malaya. My department has agreed to buy the total output until further notice; CHROME ORE: current contracts cover deliveries up to the end of October from Rhodesia and Baluchistan; up to September, 1949, from the Philippines; and April, 1950, from Turkey.

"Imported steel is purchased in bulk by the British Iron & Steel Corporation under the supervision of the Ministry of Supply."

CROMPTON PARKINSON, LIMITED, announces that all "Young" traction batteries for electric vehicles and industrial trucks despatched on or after March 1, 1949, will be covered by a proportional guarantee of four years, instead of three years, this being the outcome of developments resulting from years of research in the New Malden laboratories, improved methods and equipment, with scientific quality control in the works, and prolonged investigations of batteries in service.

Mr. V. W. Bone Leaves Ruston & Hornsby Board

Resignation Follows Serious Illness

Mr. V. W. Bone, chairman and managing director of Ruston & Hornsby, Limited, engineers and foundrymen, etc., of Lincoln, who has had a life-long association with the company and its associates, has retired. In making the announcement the directors state that, although he has recovered much of his physical strength, the serious nature of his recent illness and the consequent effects are such that he has decided to retire from business life. His resignation has been accepted with regret. Mr. Bone held the position of chairman and managing director of the company during the very trying period from the latter days of the war and through the equally difficult era during the transition of the company's production from war to peace.

He received his engineering training at the works of Ransomes, Sims & Jefferies, Limited, Ipswich, and was appointed joint managing director of that company in 1917 before going to Lincoln as works director in 1922; he has been on the board ever since. In 1930 he became managing director of the then newly formed associate company, Ruston-Bucyrus, Limited, which position he relinquished when he succeeded Mr. G. R. Sharpley as managing director of Ruston & Hornsby, Limited, in 1944; in 1948 he was appointed chairman of the company.

Mr. J. H. W. Pawlyn, deputy chairman of the company, who has been a director for 30 years, succeeds Mr. Bone as chairman. He is also chairman of Ransomes, Sims & Jefferies, Limited, and a director of Ruston-Bucyrus, Limited.

Mr. H. Riggall, assistant managing director, becomes managing director. He, too, has been connected with the company and its associates all his business life, having received his early training at Ransomes, Sims & Jefferies, Limited, prior to joining the commercial and sales side of Ruston & Hornsby, Limited, in 1921. After some considerable period as home sales manager and subsequently as commercial manager, he was appointed a director in 1936. Mr. Riggall is also a director of Ruston-Bucyrus, Limited, and of Davey, Paxman & Company, Limited, Colchester. He is a member of the Government's Engineering Advisory Committee and of the Grand Council of the Federation of British Industries. He has recently relinquished the presidency of the British Engineers' Association, but he retains his seat on the Council of that organisation.

TO SUCCEED in getting our engineering goods into Canada—a project which the Government was most anxious about—we must give a practical demonstration of our capabilities and show that we could do the job very well at competitive prices, stated Mr. G. R. Strauss, Minister of Supply, at the annual dinner of the Association of Consulting Engineers.

Obituary

MR. J. M. ALEXANDER, head traveller in the North-East area for Stewarts and Lloyds, Limited, has died at Whitley Bay. He was 56.

MR. JOEL WOODHOUSE DEAN, a retired director of the Delta Metal Company, Limited, Birmingham, died on May 17 at the age of 89.

MR. JAMES LAWRENCE MONCUR, late managing director of Mackenzie & Moncur, Limited, ironfounders, etc., of Edinburgh, died on May 20 at the age of 87.

MR. JOHN WILLIAM CURTIS, who died suddenly on May 19, was, until recently, chief engineer of West's Gas Improvement Company, Limited, Manchester. He was 65.

MR. NORMAN A. MCKEOWN, who died on May 14, was a partner in the family concern of J. & J. McKeown, engineers and ironfounders, of Grosvenor Road, Belfast. He succeeded his father, the late Mr. James McKeown, in 1936, the firm having been founded by his grandfather and a grand-uncle in the 1860's. A brother, Mr. J. Stanley McKeown, carries on the business.

SIR THOMAS BIGGART, senior partner of Biggart, Lumsden & Company, solicitors, of Glasgow, who died on May 20, was secretary of the Engineering Employers' Federation (now the Engineering and Allied Employers' National Federation) from 1896 to 1909 and secretary of the Shipbuilding Employers' Federation from 1898 to 1917. Sir Thomas, who was 87 years of age, was a member of the Grand Council and Executive Committee of the Federation of British Industries, in whose foundation he played a leading part. He was a pioneer in the drafting of national agreements respecting the industrial relationships of employers and employed, and was largely responsible for the first agreements which became a model for many others during the last 50 years.

Steel Castings Released from Price Control

Two orders varying the maximum controlled prices of some iron and steel products from June 1 have been made by the Minister of Supply. The principal alterations under the Control of Iron and Steel (No. 70) Order, 1949, are the release from price control of steel castings, cast-iron brake drums and Perkins tubes, and reductions in the prices of galvanised sheets, terneplate and galvanised wire nails. The reductions in price have been made possible by the decreased price of lead and zinc. There are also increases in prices of a small range of products.

The Control of Bolts, Nuts, etc. (No. 18) Order, 1949, increases the prices for some steel rivets.

AUTOMATIC MACHINE COMPANY, LIMITED, is being wound up voluntarily. Mr. R. McNeil, 43, Church Road, Hove, is the liquidator.

DIAMOND METAL PRESSINGS, LIMITED, is being wound up voluntarily. Mr. J. M. S. Coates, Newcastle-upon-Tyne, is the liquidator.

News in Brief

THE LONDON OFFICE of Ruston-Bucyrus, Limited, is now at 95, Aldwych, W.C.2 (telephone: Holborn 7197-8-9, 7190).

THE WORKS OF Bruce Peebles & Company, Limited, Edinburgh, will be closed for holidays from July 2 until July 11, during which time no goods will be received or despatched.

AN AGREEMENT designed to bring about a merger between the British Institute of Management and the Institute of Industrial Administration by two stages, has been signed. The merger will be completed in two or three years.

PETTERS, LIMITED, has received its largest single order ever booked for small engines. The order comes from India and is valued at approximately £150,000. It is for small Diesel engines, all of which will be delivered within the next three months.

A SMALL EXHIBITION of models, pictures and personal relics of Joseph Bramah, the engineer and inventor, will be held at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2, from June 13 to June 25. Bramah was a member of the Society of Arts from 1789 until his death in 1814.

SIMON-CARVES, LIMITED, Stockport, has secured a contract worth more than £1¼ million from the Government of New South Wales for the supply of two large steam-raising plants and associated equipment for the first section of the new power station to be built at Lake Illawarra, 50 miles from Sydney.

THE NATIONAL ARBITRATION TRIBUNAL has found against the claim advanced by engineering employees at the Naval Construction Works of Vickers-Armstrongs, Limited, Barrow-in-Furness, that certain special allowances should be at the same level for a working week of 44 hours as for one of 47 hours.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED, Billingham-on-Tees, is to erect additional plants for the manufacture of nitric and sulphuric acids, phenol, isopranol and acetone, stated Mr. P. Mayne, divisional director and chief engineer, at a recent presentation of long-service awards to 120 employees of the company.

THE ADMINISTRATIVE ARRANGEMENTS by which the Government seeks to ensure the fullest application of scientific knowledge to the solution of problems of productivity and economic development are to be reviewed. An officer of the Treasury, Commander R. G. A. Jackson, will work with and report to the secretary of the Department of Scientific and Industrial Research, Sir Ben Lockspeiser.

AFTER ALMOST A MONTH'S STOPPAGE, about 400 members of the Boilermakers' Society, who have been on strike owing to a dispute with the Blyth Dry Docks & Shipbuilding Company, Limited, Northumberland, have decided to return to work pending negotiations. The stoppage began when about 40 burners objected to the management's action in placing a fitter's labourer in charge of a new burning machine; the men contended it was a skilled man's job.

SENOR DAVID CHAVEZ PORTILLO, head of the Seccion Tecnica of the Banco Agricola de Bolivia, Casilla 1179, La Paz, Bolivia, wishes to receive a complete collection of U.K. catalogues of agricultural machinery (preferably in Spanish). Firms interested should send catalogues to the above address, at the same time notifying the Commercial Relations and Exports Department of the Board of Trade, Thames House North, Millbank, London, S.W.1 (reference: C.R.E. (I.B.) 13316/49), of any action taken.

SPEAKING at the opening of the control house of the testing station at the Hereford works of Painter Bros., Limited, structural engineers, etc., Sir Charles G. Darwin, Director of the National Physical Laboratory, paid tribute to the pioneer work of the company, over the last 20 years, in the engineering industry. He stated that the enterprise shown by the firm had been amply justified and its work, which bore all the characteristics of research, was of immense value to the country at the present time.

THE MINISTRY OF TRANSPORT has informed Stanley (Durham) Urban Council that there are no statutory powers to stop the Consett Iron Company, Limited, carrying 3,000 tons of steel billets each week by road from its Consett Works to its associated works at Jarrow. The Ministry stated that it was not satisfied with the position and was looking further into the matter. The Council, together with other local authorities, had objected on the grounds that the constant heavy loads would damage the roads.

OPENING THE Nickell research laboratories of Monsanto Chemicals, Limited, at Ruabon on May 20, Sir Ben Lockspeiser, secretary of the Department of Scientific and Industrial Research, stated that in the new laboratories (named after Dr. Lloyd Francis Nickell, chairman and managing director of the company from 1930 to 1948) there was no place for magic; but imagination would have full scope, and he believed that their establishment was an act of faith to science and to the young people who would help us to hold our place in the world.

THE MINISTRY OF FOOD announces that no change will be made in the price of refined oils and imported edible animal fats allocated to primary wholesalers and large trade users during the period ending July 16. The Ministry, in agreement with the Board of Trade, also announces that the import of sperm oil, from certain sources, will in future be allowed under specific licence. Applications for import licences should be made on Board of Trade form ILD/K to the Import Licensing Department, Board of Trade, 189, Regent Street, London, S.W.1.

BRITISH INSULATED CALLENDER'S CABLES, LIMITED, announces that its Prescot Works, Helsby Works, Huyton Quarry Works and Melling Works will be closed for holidays from July 23 to August 1. The Anchor Works, Leigh, will be closed from July 2-9, while the Willenhall Foundry will be closed from July 23 to August 2. All dates are inclusive and the works will be closed for the receipt of goods during those periods, but arrangements have been made for a skeleton staff to deal with urgent requirements. Holidays at the Erith Works, Belvedere, will be staggered and the works will not close.

FISHER & LUDLOW, LIMITED, Birmingham, has acquired a controlling interest in Bendix Home Appliances, Limited, manufacturers of the "Bendix" auto-

matic home laundry, of Park Lane, London, W.1, by the acquisition of the block of shares held by Mr. E. Beddington Behrens, chairman and managing director. Resulting from this change of control, Mr. Behrens, who recently resigned the chairmanship of Fisher & Ludlow, Limited, and Maj.-Gen. Sir C. McV. Gubbins retire from the board. Mr. A. Keats, chairman of Fisher & Ludlow, Limited, has been appointed chairman and Mr. N. Ludlow has been appointed a director.

"WE HAVE ARRIVED at an important stage in the development of the business carried on by the group and the directors have, after very careful consideration, decided that the subsidiary companies should raise £100,000 through the auspices of the Government-sponsored Industrial & Commercial Finance Corporation, by way of an unsecured loan at 4 per cent. per annum repayable in 10 years," states Mr. C. C. Griffith, chairman of Engineering Components, Limited, Slough, in the company's annual report and accounts. "It is intended," he says, "that 60 per cent. of this sum will be spent on plant, and the remainder to finance our ever-increasing export trade."

TEXTILE MACHINERY MAKERS, LIMITED, shipped new machinery and spare parts to the value of more than £10,000,000 to 47 countries during 1948, says Mr. K. H. Preston, the chairman, in his review accompanying the accounts. The export target set by the Government was exceeded in every month except January, but, owing to lack of orders, the home target was never attained. Mr. Preston states that output for the first four months of 1949 has been in excess of the similar period of last year and, although it is likely to drop during the latter part of the year, total deliveries should approximate to 1948. It seems probable, however, he adds, that they must expect a material reduction in 1950.

IT IS JUST 50 YEARS since the British Thomson-Houston Company, Limited, opened its first provincial office—in Sheffield—and the jubilee has been celebrated by the company entertaining the staff at a supper dance. Among the staff with long service were the following eight, whose combined service adds up to 250 years:—Mr. C. A. Russell (manager, Sheffield district office), 37 years; Mr. C. Moore (construction department), 44 years; Miss B. Hensman (lamp and lighting sales department), 29 years; Mr. E. T. Bussey (lamp salesman), 33 years; Mr. P. M. Erskine (construction department), 28 years; Mr. H. B. Scaife (manager, Hull depot), 27 years; Mr. G. Honnoraty (manager, Nottingham depot), 25 years; Mr. J. W. Orton (construction department), 27 years.

MR. LIONEL RANDOLPH FARRELL, manager of the Bristol district sub-office of the British Thomson-Houston Company, Limited, died recently. After a period of technical training with the Skinningrove Iron Company, Limited, Saltburn-by-the-Sea, he gained further practical experience at the works of Bolckow, Vaughan & Company, Limited, Middlesbrough. He then studied at University College, Southampton, before joining the B.T.H. Company. He was 48.

Increases of Capital

Details of increased capital have been announced by the following companies:—

POOLE FOUNDRY, LIMITED, Poole, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £9,000.

VIGOR PLANT COMPANY, LIMITED, Crayford, Kent, increased by £900, in £1 ordinary shares, beyond the registered

PENINSULAR ENGINEERING COMPANY, LIMITED, Liverpool, increased by £5,000, in £1 ordinary shares, beyond the registered capital of £5,000.

TUDOR CONSTRUCTION, LIMITED, engineers, etc., of London, W.1, increased by £9,000, in £1 ordinary shares, beyond the registered capital of £1,000.

BRADLEY & BURCH (ILFORD), LIMITED, general engineers, etc., of Ilford, increased by £3,000, in £1 shares, beyond the registered capital of £2,000.

HOLLOWAY HINSON & COMPANY, LIMITED, engineers, etc., of Chichester, increased by £1,500, in £1 ordinary shares, beyond the registered capital of £10,000.

MOSENDALE STEELS, LIMITED, Smethwick, increased by £8,000 in £1 6 per cent. redeemable cumulative preference shares, beyond the registered capital of £2,000.

A. L. DUNN & COMPANY, LIMITED, non-ferrous foundrymen, etc., of Foleshill, Coventry, increased by £6,000, in £1 ordinary shares, beyond the registered capital of £4,000.

SCALE MODEL EQUIPMENT COMPANY, LIMITED, pattern and model makers, etc., of Steyning, Sussex, increased by £2,500, in £1 shares, beyond the registered capital of £5,000.

D. R. SMITH (FACTORS), LIMITED, manufacturers of aluminium, cutlery, etc., of Cathays, Cardiff, increased by £2,000, in £1 ordinary shares, beyond the registered capital of £500.

ALEX. J. MARSH, LIMITED, coachbuilders, etc., of London, W.C.1, increased by £1,500, in 1,000 preference and 500 ordinary shares of £1 each, beyond the registered capital of £2,000.

ROSE BROS. (BIRMINGHAM), LIMITED, electrical, mechanical and fuel engineers, etc., of Birmingham, increased by £2,900, in £1 ordinary shares, beyond the registered capital of £100.

CORTURSEL, LIMITED, engineers, etc., of Southampton, increased by £5,000, in 1,000 5 per cent. redeemable preference and 4,000 ordinary shares of £1 each, beyond the registered capital of £1,000.

NORTON-HARTY ENGINEERING COMPANY, LIMITED, Great Bridge, Tipton, Staffs, increased by £25,000, in 10,000 preference and 15,000 ordinary shares of £1 each, beyond the registered capital of £55,000.

LONGCLOSE ENGINEERING COMPANY, LIMITED (formerly Longclose Foundry Company, Limited), Leeds, increased by £15,000, in £1 ordinary shares, beyond the registered capital of £15,000.

TURNER & NEWALL, LIMITED, manufacturers of asbestos, chemical products, rubber, etc., of Spotland, Rochdale, increased by £4,750,000, in £1 unclassified shares, beyond the registered capital of £7,250,000.

STENOR, LIMITED, general, mechanical, and constructional engineers, etc., of Richmond, Surrey, increased by £45,000, in £1 ordinary shares, beyond the registered capital of £5,000. On December 29, 1948, the Protocol Investment Trust of Africa (Proprietary), Limited, was allotted 45,000 ordinary shares.

COMMERCIAL RADIATORS, LIMITED, London, N.16, increased by £2,550,in 6,000 ordinary shares of 1s. each and 2,250 6 per cent. cumulative preference shares of £1 each, beyond the registered capital of £950. The existing 1,400 ordinary shares of 10s. each have been subdivided into 14,000 shares of 1s. each.

H. BURNLEY'S FOUNDRY in Norcroft Street, Listerhills, Bradford, was damaged by fire recently, the outbreak being discovered by a night watchman. His prompt action in summoning the fire brigade prevented what might have been a serious blaze.

Company News

(Figures for previous year in brackets.)

VERITYS—Dividend of 5% (same).
ROLLS-ROYCE—Dividend of 20% (same).
HARLAND & WOLFF—Dividend of 7% (same).
HOLOPHANE—Interim dividend of 7½% (same).
BROOM & WADE—Interim dividend of 7½% (same).
HARRISON (BIRMINGHAM)—Dividend of 25% (same)
ARTHUR LEE & SONS—Interim dividend of 15% (same).
SIEMENS BROS. & COMPANY—Dividend of 7½% (same).
MARCO REFRIGERATORS—Interim dividend of 12½% (same).
RANGE BOILERS—Final dividend of 15%, making 20% (same).
METAL CLOSURES—Final dividend of 20%, making 40% (same).
REYNOLDS BROS.—Final dividend of 5%, making 10% (same).
COVENTRY MACHINE TOOL WORKS—Dividend of 12½% (same).
HERBERT TERRY & SONS—Final dividend of 20%, making 30% (same).
BUTTERLEY COMPANY—Final dividend of 8½%, making 12% (same).
MINIMAX—Final dividend of 12% and bonus of 5%, making 25% (same).
ALBION DROP FORGINGS COMPANY—Interim dividend of 5% (same).
SANDERSON BROS. & NEWBOULD—Final dividend of 5%, making 10% (same).
LIGHT PRODUCTION COMPANY—Final dividend of 20% (10%), making 30% (10%).
AMBROSE SHARDLOW & COMPANY—Final dividend of 10%, making 12½% (same).
LIGHTFOOT REFRIGERATION COMPANY—Final dividend of 5%, making 8% (same).
JOHN THOMPSON—Final dividend of 10% (12½%) and bonus of 5% (same), making 22½% (same).
GERRARD INDUSTRIES—Final dividend of 10% (15%), and bonus of 5% (nil), making 25% (same).
A.P.V. COMPANY (formerly Aluminium Plant & Vessel Company)—Final dividend of 33⅓%, making 50% (same).
PLATT BROS. & COMPANY (HOLDINGS)—Dividend of 10% for the nine months to December 31, 1948 (10% for 12 months).
MOUNTSTUART DRY DOCKS—Participating preferred dividend of 8% (same) and deferred ordinary dividend of 10% (same).
S. RUSSELL & SONS—Final dividend of 7½%, making 15% on the £120,000 ordinary capital (100% on £10,800 capital). The company was made public last July.
VENT-AXIA—Final dividend of 150%, making 250% (same) and bonus of three shares of 1s. for each stock unit of 1s. The shares were introduced in June, 1948.
AUTOMATIC TELEPHONE & ELECTRIC COMPANY—Final ordinary dividend of 7%, making 10% (same) and bonus of 2½% (same). Dividend on the deferred stock of 10% and bonus of 2½% (same).
TRIPLEX FOUNDRY—Profit to March 31, before tax, £26,037 (£37,622); to tax, £13,850 (£19,750); leaving £12,187 (£17,872); brought in, £16,206 (£8,384); adjustment of tax reserve, £509 (£469); dividend of 10% (same); forward, £18,383.
JOHN HETHERINGTON (HOLDINGS)—Revenue to March 31, £5,470 (£5,354); to directors' emoluments, £500 (£400); general expenses, £437 (£670); tax, £1,976 (£1,999); leaving £2,556 (£2,285); to capital reconstruction expenses, £149 (nil); dividend of 3.3% (same); forward, £942 (£758).
ACTON BOLT—Profit for 1948, after tax, £69,984 (nine months to December 31, 1947, £34,134); tax adjustments, £532 (£9,957); to additional tax reserve, nil (£5,000); general reserve, £40,000 (£25,000); dividend reserve, £11,687 (nil); dividend of 10% (7½% actual for nine months); forward, £32,081 (£24,940).
BANKS & DAVIS—Trading profit to March 31, £21,319 (£31,848); interest and dividends, £187 (£253); to directors' fees, £552 (£500); audit fee, £158 (same); depreciation, £527 (£208); profits tax, £3,550 (£5,700); income tax, £5,715 (£11,365); leaving £11,004 (£14,170); final dividend of 25%, making 100% (same); forward, £31,933 (£27,072).
R. B. PULLIN & COMPANY—Consolidated trading profit to September 30, 1948, after depreciation, fees, etc., £6,615; profit on sale of fixed assets, £1,715; to taxation, £16,300; reserve for dilapidations, £100; profits, less losses, of subsidiaries relative to shares acquired during the year, £191; deficiency, £8,291; increasing the debit forward to £60,828.
G. HOPKINS & SONS—Consolidated trading profit for 1948, £64,843; to directors' emoluments, £8,315; auditors' remuneration, £700; depreciation, £4,413; net trading profit, £51,415; sundry revenue, £2,938; brought in, £21,360; available, £75,713; to tax, £26,726; parent company's dividends, £13,488; attributable to minority holder, £49; capital duty, etc., £1,073; forward, £34,377.
HUDSON & WRIGHT—Trading profit for 1948, £110,518 (£99,544, plus £1,698 tax written back after £8,000 to deferred repairs); to directors' emoluments, £15,758 (£14,229); depreciation, £4,205 (£3,271); profits tax, £13,267 (£11,750); income tax, £38,127 (£31,132); leaving £39,161 (£40,860); to stock reserve, £15,000 same); general reserve, £10,000 (same); dividend of 40% (same); forward, £12,820 (£12,959).
BRUNTONS (MUSSELBURGH)—Consolidated trading profit for 1948, £76,108; investment income, £10,344; parent's trading profit, £59,865 (£59,772); investment income, £14,068 (£11,194); other income, £8 (£145); to tax, £25,700 (£32,000); depreciation, £17,766 (£14,642); staff pension, £1,885 (£1,513); directors' fees, £800 (£1,000); house property expenditure, £1,038 (nil); leaving £26,753 (£21,956); dividend of 15% (same); forward, £52,476 (£54,598).
SYDNEY S. BIRD & SONS—Consolidated trading profit for 1948, £25,957 (£68,878); to directors' fees, £1,100 (£1,300); other remuneration, £4,504 (£13,311); audit, £300 (£405); goodwill and formation, nil (£413); depreciation, £6,355 (£6,140); profits tax, £2,803 (£7,800); income tax, £5,627 (£18,932); net balance, £5,268 (£20,577); brought in, £9,421 (£10,379); taxation freed, £4,500 (nil); to general reserve, £5,000 (£10,000); employees' fund, £1,000 (same); dividend of 10% (30%), £8,748 (£5,362); forward, £9,614 (£9,421).
CHARLES CLIFFORD & SON—Consolidated accounts for 1948 show trading profit, £115,241 (£154,030); to directors' emoluments, £13,150 (£17,280); depreciation, £15,427 (£14,808); income from investments, £994 (£1,301); to tax, £76,100 (£102,600); net profit, £40,135 (£51,731 after transfer of £1,000 to Melvin Benevolent fund); to outside interests, £387 (£713); stock reserve, £26,268 (nil); staff pensions, £10,000 (nil); general reserve, nil (£30,000); dividend of 17½%, tax free (same); forward, £43,556 (£51,566).
B. FINCH & COMPANY—Trading profit for 1948, £81,731 (£104,181); to directors' remuneration, £13,478 (£11,412); bank interest, £494 (£5,522); mortgages interest, £183 (£281); audit fees, £375 (£300); pension, £2,156 (£1,836); depreciation, £6,476 (£4,394); leaving £58,571 (£80,437); to tax, £30,578 (£40,728); preference dividends, £6,000 (£3,000); off goodwill, nil (£10,000); reserve, nil (£8,500); directors' additional remuneration, nil (£1,000); final dividend of 24%, making 30% on larger capital (30%); forward, £18,835 (£16,642).
ROBEY & COMPANY—Trading profit for 1948, £85,140; interest, £277; to depreciation, £13,266; directors' fees, £750 (total emoluments were £10,300); debenture trustees' fees, £50; taxation, £19,449; debenture interest, £1,938; debenture sinking fund, £258; leaving £49,706, to which is added £13,928 tax over-provision and £24,858 brought in from last year, making available £88,492; to general reserve, £40,000; employees' benevolent reserve, £10,000; preference dividend, £1,659 net; ordinary dividend of 10% (same); forward, £32,537.
G. & J. WEIR—Consolidated revenue in 1948, £1,007,774; to audit expenses, £1,535; loan interest, £17,034; depreciation, £124,114; contingent claims, £10,000; deferred repairs, £10,000; tax, £456,485; net profit, £388,605; to outside shareholders' interests, £1,673; profits held by subsidiaries, £106,911; profit of parent company, £280,021 (£210,052); provision for subsidiary loss not required, £45,000 (same); brought in, £256,582 (£239,539); available, £581,603 (£404,591); final dividend of 30%, making 40% (same); to general reserve, £175,000 (nil); forward, £258,594.
LILLESHALL COMPANY—Trading profit, etc., for 1948, £50,717 (£88,238); income from investments, £196 (£107); to directors' remuneration, £7,421 (directors' fees £1,400); depreciation, £10,049; staff pension contribution, £1,149 (£1,474); taxation, £9,539 (£29,480); leaving £22,755 (£55,991); dividends from subsidiary, £4,464; to preference dividends covering the second half of 1947, the whole of 1948, plus additional dividends for 1947 and 1948, £38,350 (first half of 1947 £5,250); ordinary dividend of 20% for 1948, £4,200, plus 40% for 1947, £8,400; forward, £105,031 (£118,762).
RIO TINTO COMPANY—Net return on sales of produce, etc., for 1948, £695,733 (£775,096); net income from trade

investments, £261,824; other investments, £3,287; net dividends from subsidiaries, £32,161; sundry interest, £2,191; to expenses, current taxes, etc., £431,625; (£561,529); audit, £350; staff pension, £18,487 (£6,381); depreciation on plant and outlay, £125,273 (£23,765); written off mines in Spain, £71,098 (nil); directors' emoluments comprised—as directors £9,593, "other" £3,751, less £5,000 paid by a subsidiary; dividend of 10% (8%), tax free; balance unappropriated, £840,070 (£741,820).

BRITISH THERMOSTAT COMPANY—Consolidated trading profit to January 31, £342,392 (£253,207); other income, £731 (£553); to directors' remuneration, £20,507 (£12,330); audit fees, £925 (£750); depreciation and amounts off fixed assets, £24,771 (£12,143); leaving £296,920 (£228,537); parent company's balance, £228,871 (£191,284); to profits tax, £30,000 (£25,000); income tax, £90,000 (£75,000); off patents, nil (£7,999); off shares premium in Packless Gland, nil (£1,360); general reserve, £50,000 (£35,000); final dividend of 17½%, making 25% (23¾%, including bonus of 5%); forward, £108,053 (£73,282).

PROJECTILE & ENGINEERING COMPANY—Trading profit for 1948, plus sundry income, £98,357 (£69,501); to depreciation, £29,126 (£32,626); directors' emoluments, £7,963 (£8,404); former director's pension, £100 (same); director's compensation, £8,500 (nil); debenture interest, £2,772 (same); bank interest, £109 (nil); auditors' remuneration, £525 (same); taxation, £6,129 (£5,662); net profit, £43,133 (£19,412); provisions relating to previous years, not now required, £28,500 (nil); to general reserve, £48,700 (nil); staff pension fund, £1,000 (nil); dividend of 12½% (10%); forward, £45,328 (£44,020).

G. BEATON & SON—Consolidated trading profit in 1948, plus sundry revenue, £72,913 (£29,946); to depreciation, £10,458 (£9,770); directors' remuneration, £2,300 (£2,361); tax, £21,500 (£5,250); net profit, £38,655 (£12,565); net trading profit of parent company with sundry revenue, £54,001 (£24,568); to depreciation, £8,298 (£8,167); directors' remuneration, £2,300 (£2,098); tax, £21,500 (£5,250); leaving £21,903 (£9,053); brought in, £3,354 (£1,153); recovered E.P.T., £16,991 (£10,648); available, £42,248 (£20,854); to general reserve, £8,508 (£6,000); contingencies, £5,000 (£6,000); deferred repairs, £4,288; dividend of 10% (same) and bonus of 5% (nil); forward, £16,202.

HOPKINSONS—Trading profit for the year ended January 31, £568,289 (£333,715 adjusted figure); investment interest, £8,432 (£9,983); sale of investments, £1,096 (£3,805); to depreciation, £42,825 (£33,210); loss on sales and scrapping of assets, £4,177 (£1,105 profit); directors' emoluments, £29,687 (£20,523); auditors' fees, etc., £454 (£483); tax, £257,000 (£149,710); leaving £243,674 (£144,682); withdrawn from tax reserve, £3,723 (£3,415); brought in, £156,831 (£129,327); to general reserve, £50,000 (same); contracts maintenance reserve, £3,000 (£10,000); investment reserve, £1,096 (£3,805); variations in prices of materials reserve, £40,000 (nil); final dividend of 15%, making 22½% (same); forward, £253,344 (£156,831).

HALL TELEPHONE ACCESSORIES (formerly H.T.A.)—Trading profit for 1948, after charging operating expenses and development work, £79,077 (£52,858); to directors' remuneration, £9,500 (£8,400); depreciation, £13,302 (£12,929); pensions, £443 (£2,625); audit, £367 (same); net profit, £55,465 (£28,537); tax over-provision, £5,125 (£20,692); price adjustments on Government contracts, £13,123 (nil); dividends, nil (£1,846); E.P.T. recoverable, nil (£13,727); brought in, £26,653 (£15,622); to price adjustments on Government contracts, nil (£9,530); E.P.T. arising from retrospective price adjustments, £1,982 (nil); profits tax, £11,500 (£6,500); income tax, estimated, £18,250 (£10,000); investment reserve, £25,000 (general reserve £10,000); dividend of 10% (same); forward, £25,893.

NEWMAN INDUSTRIES—Consolidated profit and loss account to January 1 shows balance from trading account, £204,668 (£215,691); other income, £315 (£1,508); to directors' emoluments, £16,086 (£13,271); depreciation, £56,540 (£49,077); pension fund, £830 (£1,240); interest on bank advances, £18,061 (£7,231); written off investment in former subsidiary, nil (£1,050); taxation, £63,833 (£82,205); leaving £49,633 (£63,125); provisions not now required, £27,923 (nil); to capital redemption reserve, £12,735 (nil); dividend on the 6% redeemable convertible cumulative preference shares, £105 (£504); dividend on the 6% participating preferred ordinary shares, £1,980 (same); final ordinary dividend of 10% (12½%), making 17½% (22½%, including bonus of 2½%); forward, £99,489 (£69,711).

ALUMINIUM CORPORATION—Trading profit for 1948, £78,309 (adjusted figure £94,462); investment income, £545 (£918); profit on sales of fixed assets, £1,162 (loss £7,862); profit on sale of trade investment, nil (£4,146); surplus on realisation of investment in preference shares of a fellow subsidiary, £5,512 (loss £2,798); to audit fee and expenses, £432 (£366); depreciation, £9,621 (£8,721); loan interest, £4,000 (same); debenture interest, £10,500 (same); compensation for loss of office paid to general manager, nil (£8,000); directors' emoluments, etc., £4,420 (£5,075); taxation, £22,786 (£26,345); net profit, £33,769 (£28,657); taxation previously over-provided, nil (£8,225); stock reserve, £2,463 (£548 credit); general reserve, £10,000 (£10,000); reserve towards debenture redemption premium, £5,000 (£10,000); plant replacement reserve, £10,000 (nil); dividend on the ordinary and "A" ordinary shares of 10% (same); forward, £15,486 (£13,305).

ENGINEERING COMPONENTS—Group profit for 1948, £251,348 (£280,554); investments income, £800 (nil); to depreciation, £18,490 (£18,823); directors' emoluments, £12,090 (£9,610); auditors' remuneration, £957 (£886); preliminary expenses of Australian subsidiary, £406 (nil); staff pension fund, £3,778 (£2,898); employees' welfare fund, £3,600 (same); tax, £112,368 (£129,038); net profit of group, £100,459 (£115,699); overprovision for tax in prior years, £968 (£4,062); to profits retained by subsidiaries, £64,584 (£85,104); net profit of parent company, £36,843 (£34,647); brought in, £15,477 (£28,930); balance available, £52,320 (£63,577); to dividend equalisation reserve, nil (£25,000); final dividend of 15% and bonus of 5%, making 30% (same); forward to Engineering Components, £29,220 (£15,477); subsidiaries' profit retained in accounts, £64,584 (£85,104); brought in, £30,840 (£77,370); to transfers to general reserves, £50,000 (£131,634); leaving £45,424 (£30,840); forward to consolidated balance-sheet, £74,644 (£46,317).

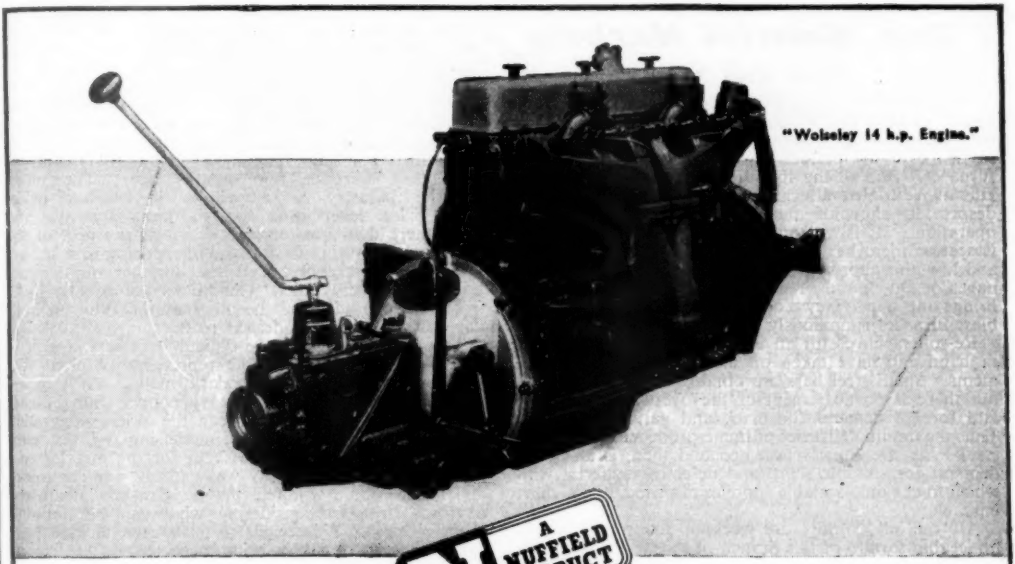
W. T. HENLEY'S TELEGRAPH WORKS COMPANY—Consolidated accounts for 1948 show trading balance, after charging directors' emoluments, £1,568,229 (£1,364,436); income from investments, £81,756 (£58,432); profit on realisation of investments and other assets, £194,989 (£9,277); amounts received relating to earlier years, nil (£28,076 net); to depreciation, £190,861 (£119,318); payment relating to earlier years, £18,978 net (nil); tax, less adjustments, £754,408 (£594,454); relief from U.K. tax in respect of initial allowances, carried to reserve, £39,018 (nil); written off investments, nil (£13,747); profit, £841,709 (£732,702); to general reserve £125,000 (nil); replacement of buildings and plant, £100,000 (nil); fluctuations in prices of materials, £157,000 (£67,000); post-war contingencies, nil (£175,000); special depreciation of buildings and plant, nil (£60,000); education purposes, nil (£20,000); to staff pensions, £150,000 (£100,000); dividend of 15% and bonus of 5% (same), £178,750 (£143,000); forward, £866,313 (£740,304), including capital profits of £219,073.

UNION STEEL CORPORATION (OF SOUTH AFRICA)—Consolidated trading profit for 1948, £502,118 (£577,403); dividends and interest, £29,358 (£23,134); fees, £183 (£256); to general expenditure, £37,779 (£36,030); depreciation, £87,481 (£85,714); directors and London committee fees, £1,550 (£1,450); leaving £404,849 (£477,599); brought in, £143,977 (£103,620); reserves no longer required, nil (£5,000); disposal of non-trading assets, nil (£644); rebates, recoupments and adjustments, £22,698 (nil); sale of investments, £6,298 (nil); to tax, £119,421 (£97,041); new issue expenses, nil (£20,839); losses and expenditure of capital nature, £2,100 (£10,081); attributable to minority interests, £1,000 (nil); employees' benefit fund, £50,000 (£5,060); directors' additional remuneration, £5,000 (£4,925); general reserve, £100,000 (same); employees' recreation club, nil (£75,000); preference dividend and bonus, £31,250 (£25,000); ordinary dividend of 10% (8%) and bonus of 2½% (2%), £131,250 (£105,000); proportion of subsidiary profits attributable to minority interests, £2,310 (£2,261); forward, £135,491 (£141,716).

Mr. E. B. Hall Honoured

Mr. Ernest B. Hall, chairman of Hall & Pickles, Limited, Manchester and Sheffield, has completed 21 years in the offices of chairman and, subsequently, president of the National Association of Iron and Steel Stockholders, and a private dinner was held at the May Fair Hotel, London, W.1, on May 19 in his honour. There were over 100 present to express their thanks to Mr. Hall for his past services.

During the war Mr. Hall was adviser on stockholding and merchanting matters to the Iron and Steel Control.



A NUFFIELD PRODUCT

Using

STANTON-DALE

REFINED PIG IRON

USED AND RECOMMENDED
FOR ALL HIGH-DUTY
ENGINEERING CASTINGS

THE STANTON IRONWORKS COMPANY LIMITED, Nr. NOTTINGHAM

Raw Material Markets

Iron and Steel

The stringency in regard to pig-iron supplies is still acute. All the big integrated steel plants provide their own metal for the melting shops and have been able to tide over the periods required for relining of blast furnaces. But all the foundries have been working of late on restricted allocations of pig-iron and are still desperately short of material to sustain their normal operations. It is not only common foundry iron that is scarce; there has also been quite a run on hematite and low-phosphorus grades and not inconsiderable tonnages of Dutch and French iron have been imported to bridge the gap. News of the restarting of additional blast furnaces is anxiously awaited.

Re-rollers have still an impressive volume of orders in hand and have taken on increased export commitments. Small steel bars are obtainable at short notice, but there is no abatement of the overwhelming home and foreign demand for black and galvanised sheets. Thus maximum deliveries of home-produced and foreign steel semis are eagerly accepted and there is an active demand for suitable scrap and defective material with which to eke out available supplies of prime billets, sheet bars, etc.

All the plate mills are working to capacity and a noticeable feature of this branch of the steel trade is the unusually high proportion of specifications for thin plates under ¼ in. thick. The usual sizes of sections are in steady demand, but there is scope for expansion of the trade in heavy joists and sections as capital investment works receive official sanction. Railway requirements at home and abroad promise full employment for the producers of rails, sleepers, chairs, points and crossings, and the wire mills, now well supplied with rods, are working to capacity.

Non-ferrous Metals

The increase of ¼ cent in the copper price to 18¼ cents in New York did not last long, and it was only a question of days before the quotation dropped back to 18 cents again. Since then the tendency has been downwards, and last week saw some price cutting in connection with an inquiry for 300 tons of copper for the United States Mint. It looked as if suppliers were anxious to have the business, for, according to a report from New York, the American Metal Company offered as low as 17½ cents. This certainly sounds as if the fall in copper has not yet come to an end, and, indeed, the whole price structure in the United States, so far as metals are concerned, is the reverse of steady. Lead and zinc are certainly in the van of the downward movement, for last week the former fell to 13 cents, a decline of 1 cent per lb., while the latter came down from 12 cents to 11 cents. While there has been some reduction in the numbers of unemployed in the United States, sentiment is not very cheerful, and on Wall Street there have been some sessions of depressed trading. Unfortunately for the metal trade in the United Kingdom, the prices maintained by the Ministry of Supply are a very long way in excess of the parity of the New York quotations, and therefore of world prices.

Among consumers the policy of buying only on a hand-to-mouth basis is being rigidly observed, and since the mills are finding that their customers are keeping purchases down to a minimum, they are probably acquiring less metal from the Ministry than they were a few months ago. The effect on the industry as a whole of keeping prices at a false level must be to limit activity, and since there does not seem to be much prospect of the Government cutting its losses and reducing to a proper level, we must expect that the summer months are going to be very quiet. Conditions are equally quiet in the scrap trade, and the onset of the Whitsun holiday certainly has not helped matters.

Values in old metals are difficult to assess, and it is virtually impossible to quote representative prices for the various grades of secondary metal. At a guess one might suggest £65 for heavy copper, but there is a fairly wide variation between the prices suggested. Last week's debate on bulk purchasing did not contain any very heartening passages for the metal trade, for the Minister of Supply was entirely non-commital, and many people will feel that it is rather late in the day now to start considering what can be done to effect changes. This ought to have been tackled long ago, before the break in prices occurred.

E.C.A. Guarantee for U.K. Plant

The Economic Co-operation Administration announced last week the signing of an industrial guarantee contract with the Metallizing Engineering Company, Inc., Long Island City, N.Y., for an investment of $45,000 in the United Kingdom. The company is a manufacturer and supplier of equipment and materials for metal spraying in repair and salvage of industrial machinery. It has been exporting its products to England and other countries for a number of years. It is now making a dollar investment in a new British subsidiary, the Metallizing Equipment Company, Limited, at Chobham, Surrey, to produce equipment, accessories and metallising supplies similar to those produced by the parent firm. The new company's business in Great Britain is expected to total about $400,000 yearly when peak production is reached in three years. Of this amount, about one-half is to be exported from England to other nations outside the dollar areas.

Standard Wrapped Bushes

The range of standard wrapped bushes marketed by the Glacier Metal Company, Limited, Alperton, Middx, has been extended to include bushes with 3-in. bores. There are now 198 English sizes in the range, from ¼-in. to 3-in. bores, and 127 metric sizes, from 10-mm. to 58-mm. bores. Each size is made in large quantities by economical production methods and all the standard sizes can be supplied immediately. An up-to-date wall chart has been published and copies can be obtained on application to the company.